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MACHINERY

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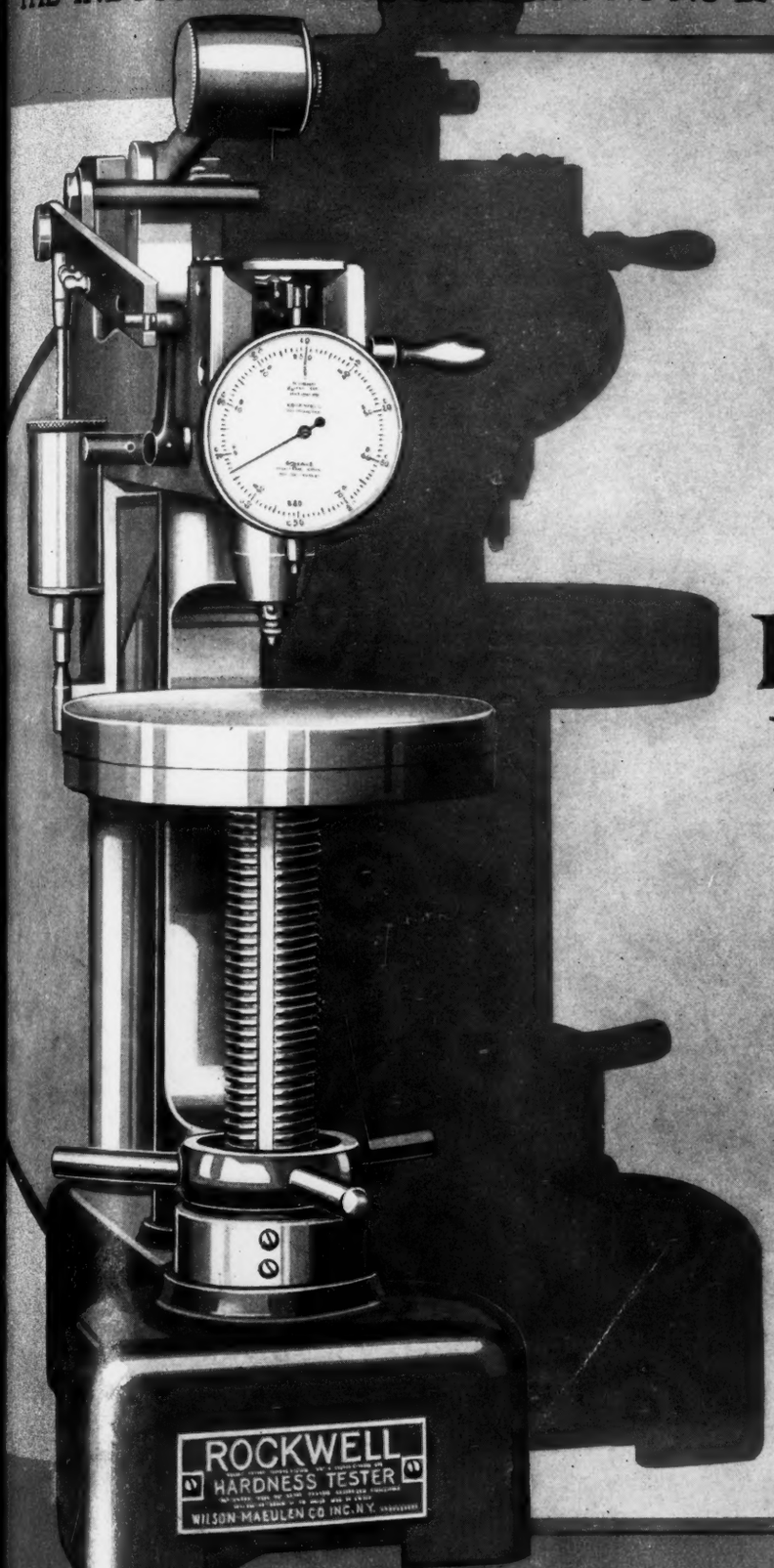

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The Wilson-Maeulen Company also make Pyrometers and Controllers.

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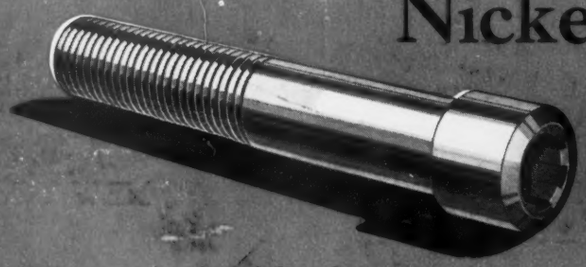
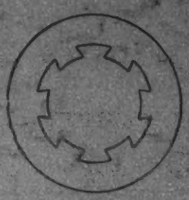


Bristo socket head Cap Screws are made to take the terrific strain of heavy punch and die, stamping and similar work. They have a generous margin of strength and toughness which can be acquired only by forging nickel alloy steel.

This extra strength means longer life and time saved by less frequent replacements—lower maintenance expense. In your product, Bristo Cap Screws give added assurance of dependable performance and satisfied customers.



Bristo Cap Screws and Set Screws have the most effective socket design ever devised. It gives the wrench a perfect grip on the screw.

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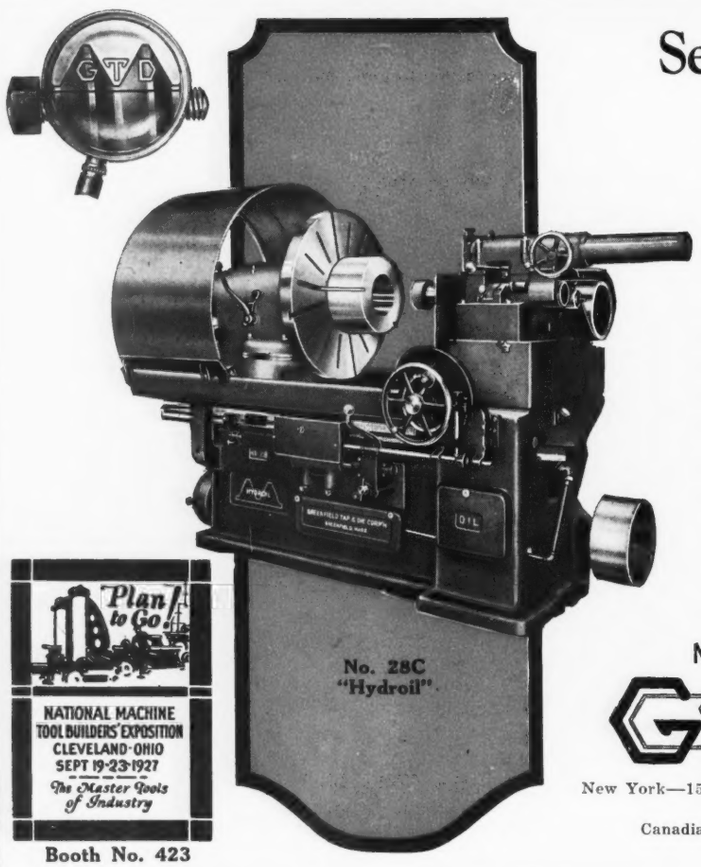
Let us send you sample screws to test. Try them on the hardest job in the shop. See them in action.

When you write for test samples, ask for the new discounts and Bulletin 821-E, describing the line. The Bristol Co., Waterbury, Conn., makers of Bristo hollow set safety screws.

BRISTO CAP SCREWS

Patented Socket Design — *The Wrench Grips the Screw*



No. 28C "Hydroil"

NATIONAL MACHINE TOOL BUILDERS' EXPOSITION
CLEVELAND·OHIO
SEPT 19-23-1927
The Master Tools of Industry

Booth No. 423

See It at Cleveland

The new No. 28-C Heavy Duty "*Hydroil*" will be in operation at our booth at the Cleveland Show.

This is a machine that will grind holes up to 32″ in diameter in parts swinging up to 48″. It represents a new application of grinding. One purchaser is chalking up savings of $23.40 every eight hour day.

SEE IT!

MACHINE TOOL DIVISION

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

New York—15 Warren Street
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Detroit—224-226 W. Congress St.
Canadian Plant—Greenfield Tap & Die Corporation of Canada, Ltd., Galt, Ontario.

The Cleveland Machine Tool Exposition

THE exposition of machine tools and shop equipment to be held in Cleveland during the week beginning September 19 marks an epoch in the American machine tool industry. Never before has such a large number of machine tools, almost all of new or improved design, been assembled under one roof. With few exceptions, every machine tool builder in the United States will be represented, and in addition, there will be extensive exhibits of small tools, accessories, and other shop equipment. In all, there will be close to 200 exhibitors.

Machine Tools, the Master Tools of Industry

Back of practically every product in our entire civilized existence today stands the machine tool. The paper on which this article is printed is produced by machinery made by machine tools. The textile machinery that weaves or knits delicate silk fabrics, the woodworking machinery that produces our furniture, the equipment of the thousands of plants engaged in the manufacture of food products, the engines and cars that haul these products to the market, the huge electrical machines that make possible the use of the hundred and one different electrical appliances in the home, office, and factory, and that make modern life convenient to a degree that would have been like a page out of a fairy tale only fifty years ago—all this machinery and equipment is produced by the use of machine tools.

Therefore, one is well justified in calling the production of machine tools, *the* basic industry. During the war we became used to the expression "essential industry." Of all essential industries, the one making machine tools is the most essential; to all the key industries, it is the master key.

When Dexter S. Kimball, Dean of the Sibley Engineering School of Cornell University, in an address before the National Machine Tool Builders' Association, called machine tools the "Master Tools of Industry," he expressed in a very few words a truth that is grasped and fully appreciated by very few outside of the machinery field. Our present civilization is primarily an industrial civilization. Remove the industrial aspect and not a great deal is left that former civilizations did not possess in one form or another. It is mechanical power and industrial machinery that have made our present civilization and culture possible; and back of our industrial machinery are the machines that produce machines—the machine tools. All other machinery is produced by them—hence, they are truly called the MASTER TOOLS OF INDUSTRY.

The exposition to be opened in Cleveland Monday morning, September 19, is the first one held by the National Machine Tool Builders' Association. It is most fitting that Cleveland should be selected as the place to hold this exposition. Cleveland is in the very center of the industrial area of the United States. Half of the population of the United States and Canada live within a radius of 500 miles of this city, and it may be reached over night from almost every large industrial center in the country.

As an exposition and convention city, it has unusual facilities. The six leading hotels alone have 4000 rooms, each with private bath. In addition, Cleveland has many magnificent apartment hotels capable of taking care of the overflow of expositions and conventions, as well as numerous smaller hotels, which offer excellent accommodations.

Cleveland, a City of Great Industries

Cleveland itself is a city of great industrial activity. There are more than 3000 plants, together manufacturing in excess of a billion dollars worth of products. Two hundred thousand people are employed in the offices and shops of these plants. The capital invested exceeds $750,000,000.

Cleveland has become a large industrial center because its geographical location is unusually favorable, and it is one of the large iron and steel centers of the country. It is the receiving point annually for more than 10,000,000 tons of iron ore. While a great deal of this ore, arriving by lake steamers, is reshipped to other cities, enough of it goes into Cleveland blast furnaces to make the iron and steel business the largest industry of that city, its value equalling one-third the value of all other Cleveland-made products combined.

Courtesy Convention Board, Cleveland Chamber of Commerce

The Magnificent Public Square in Cleveland from which Transportation Lines Radiate to All Parts of the City

The manufacture of iron and steel in Cleveland dates back to 1828, when one small smelter was established. From that time on the industry has gradually developed until today Cleveland blast furnaces have a capacity of nearly 3,000,000 tons of pig iron annually; and one plant alone has a capacity of more than 700,000 tons of steel products a year.

The Diversity of Cleveland's Industries

From the pioneer industry—iron and steel—many other lines of manufacturing have developed until it may safely be said that Cleveland has few, if any, rivals in the diversity of its industries. Of the many hundreds of different lines of manufacture classified by the United States Census Bureau, 83 per cent are represented in Cleveland.

The value of the annual output of the foundry and machine shop products of the Cleveland shops amounts to over $150,000,000. In addition, automobiles and automotive parts are manufactured to a value of $154,000,000. The first steam-propelled automobile was made in Cleveland, and that city, next to Detroit, is the leading one in the production of automobiles and trucks. In the production of automobile parts and accessories, it is said to be the leading city in the country, and the largest plant in the world devoted exclusively to the making of commercial vehicles is located in this city.

Little did Moses Cleaveland, who set out in the spring of 1796 from Old Wyndham, Conn., to survey a tract of 3,000,000 acres in what is now northern Ohio and who laid out the site of a city a mile square on the bluffs overlooking the lake at the point where the Cuyahoga River enters Lake Erie, dream that he was planning one of the large cities of the world, having in 1926 an estimated population, including the suburbs, of 1,150,000. As a matter of fact, he apparently thought that his imagination was carrying him rather far afield when he returned to Connecticut and said that he believed the new town that he had surveyed would some day be "as large as Old Wyndham."

Statue of Moses Cleaveland, the Founder of Cleveland, Who Expressed the Belief that It would Some Day be as Large as His Connecticut Home Town, Old Wyndham

New Machines and Equipment to be Seen at the Exposition

Among the new machines, tools, and shop appliances described in this number of MACHINERY, beginning on page 5, will be found some of the outstanding new developments which will be exhibited at the Cleveland show. Nowhere can a man responsible for production see in operation a larger number of modern machine tools than at this show. Nowhere can he obtain, in a brief period of time, a more comprehensive knowledge of the present state of the machine tool building art. Nowhere can he learn more about the needs of his own plant and the facilities offered by machine tool builders for improving the quality and reducing the cost of his product.

Automotive Engineers Hold Production Meeting During the Exposition

The Society of Automotive Engineers will hold part of its Production Meeting in Cleveland during the exposition, sessions being held in the forenoons and evenings of Monday and Tuesday, September 19 and 20. The afternoons are left open for visiting the exposition. These meetings will be held at the Hotel Winton. The subjects to be dealt with will cover tools, jigs, and fixtures; manufacturing methods; and standardization.

Detroit Steel and Machine Tool Exposition

DETROIT — the automobile city — will provide the stage for the Ninth Annual National Steel and Machine Tool Exposition to be held there in conjunction with the annual convention of the American Society for Steel Treating during the week beginning September 19. The exposition will be held in the Convention Hall, where nearly 300 exhibitors of steel, heat-treating equipment, machine tools, small tools and shop accessories will be represented.

The convention of the American Society for Steel Treating will be held at the Statler Hotel. A program of more than forty-five papers covering almost every branch of the steel and heat-treating field will be presented. Sessions will be held both morning and afternoon during the entire week.

Some of the subjects to be discussed in the papers presented before the society are ball bearing steels; comparison of Brinell, Rockwell, and scleroscope tests; machineability of metals; wear of plug gages; effect of quenching on high-speed steel; and properties of various alloy steels. E. R. Frost of the National Machinery Co., Tiffin, Ohio, will read a paper on "Forging Machine Die Practice"; W. J. Merten of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., on "High Temperature Treatment of Castings and Forgings"; and H. B. Allen of Henry Disston & Sons, Inc., Philadelphia, Pa., on "The Manufacture and Use of Hacksaw Blades."

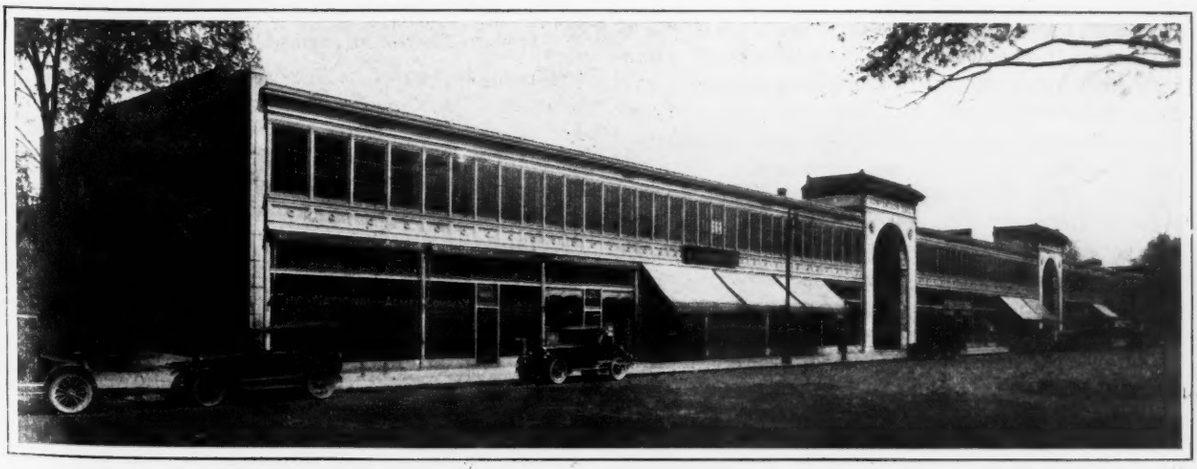
In conjunction with the exposition, three other national societies will also hold conventions and meetings in Detroit. After adjourning from a two-day session at Cleveland, the production meeting of the Society of Automotive Engineers will meet again at the Statler Hotel in Detroit, morning and evening sessions being scheduled for Wednesday and Thursday, September 21 and 22. The afternoons are left open for visiting the exposition. The subjects to be dealt with will cover non-productive materials; relation of metallurgy to production; production engineering; and time study and rate setting.

The Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers will discuss non-ferrous metallurgy at sessions held at the Book-Cadillac Hotel.

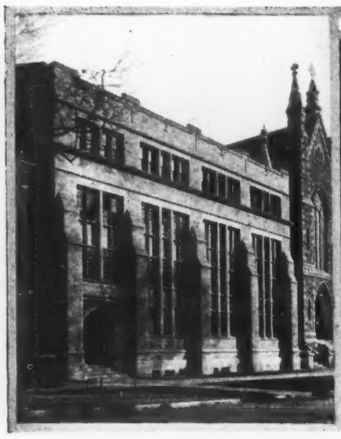
The American Welding Society will hold its fall meeting at the Book-Cadillac Hotel. Technical sessions will be held Tuesday morning and afternoon, Wednesday morning, and Thursday morning and afternoon. The subjects to be discussed cover airplane welding; welds subjected to high temperatures; automobile welding; production welding of water heaters; welding of structural steel; and the design of steel plate work for welding.

A special section of the Convention Hall where the National Steel and Machine Tool Exposition will be held, covering over 10,000 square feet, has been set aside for a welding exhibition, where all exhibits relating to welding will be grouped together and an opportunity will be provided for observing the latest and best equipment in this field. Former exhibitions of the American Welding Society have occupied less than half the space that will be given to such equipment in Detroit.

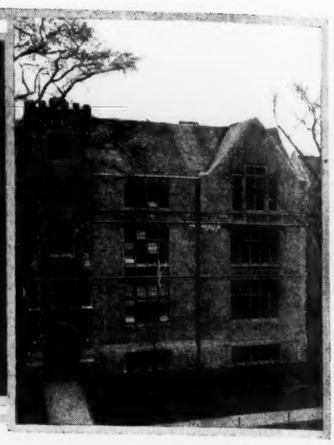
A large number of the automobile plants in Detroit will open their doors to visiting engineers and executives during the exposition.



Convention Hall, Detroit, in which the Exposition will be Held



Exhibition and Shop Practice Meeting at New Haven



THE seventh annual New Haven Machine Tool Exhibition will be held in the Mason Laboratory, Sheffield Scientific School, Yale University, New Haven, Conn., September 6 to 9. This exhibition is sponsored jointly by the New Haven local section of the American Society of Mechanical Engineers, the New Haven Chamber of Commerce, and the Department of Mechanical Engineering of the Sheffield Scientific School. The exhibition is operated wholly on a non-profit making basis by a committee of representatives of the organizations mentioned, the members of this committee giving their time and effort to this work with the feeling that a worthwhile service is thus rendered to the industry.

Shop Practice Meeting will be a Feature of the Exhibit

In connection with the exhibition, there will be a series of technical sessions dealing with new developments and problems in the design, manufacture, use, and operation of machine tools. The Machine Shop Practice Division of the American Society of Mechanical Engineers will hold its first national meeting during the exhibition, sessions being planned for the mornings of September 7, 8, and 9. The exhibition itself will be closed during the meetings so that the technical sessions will not detract from the attendance of the show, and the exhibit will not detract from the attendance at the technical sessions.

One of the meetings will be devoted to the selection of machine tool equipment, at which time Myron Curtis, chief engineer of the Potter & Johnston Machine Co., Pawtucket, R. I., will present a paper on "The Economics of Machine Tool Replacement," in which he will outline present market conditions and tendencies in machine tool design, and make a comparison between new and former types of machine tools, pointing out the savings effected by replacements. At the same session, L. C. Morrow, managing editor of the *American Machinist*, will speak on "Shop Equipment Policies in Representative Plants." This paper will deal with the reasons for discarding equipment, the time in which new equipment must pay for itself, methods used for buying and for determining when equipment should be discarded and faults of machine tools as pointed out by users.

Putting Final Finish on Shop Equipment

One session will be devoted to the problem of finishing mechanical equipment. The principal speakers at this session will be W. R. Atwood of the Chemical Products Division of the E. I. DuPont de Nemours & Co., Parlin, N. J., whose subject will be "Modern Finishes for the Machine Tool Industry"; and B. H. Divine, president, Divine Brothers Co., Utica, N. Y., who will speak on "The Prerequisites of Successful Polishing."

In his paper on machine tool finishes, Mr. Atwood will present the advantages of the use of new materials that have been introduced within the last few years, referring particularly to the pyroxylin lacquers that are now available and that have been adopted so largely in the automobile industry under the name "Duco" finishes. In his paper he will point out the saving of time possible by the use of these newer finishes and also refer to the fact that they are proof against a greater number of chemical agents than the ordinary oil-base paints that are now in general use.

Foremanship Training

A session on foremanship training will be under the direction of John T. Faig, president of the Ohio Mechanics Institute, Cincinnati, Ohio. At this session James A. Moyer, state director of University Extension, Massachusetts Department of Education, Boston, Mass., will present a paper on "Education for Foremanship." In this paper, Mr. Moyer will point out that foremanship training is valuable if for no other purpose than to make foremen understand and appreciate the ultimate aims of management in connection with production methods, personnel relations, and other activities within the foreman's sphere of duty.

Anti-friction Bearings in Machine Tools

Another session will be devoted to anti-friction bearings. Robert F. Runge, vice-president, S K F Industries, Inc., New York City, will speak on "Recent Developments in the Application of Anti-friction Bearings to Machine Tools." In this paper, illustrations of a variety of designs will be given and the importance of proper lubrication and methods of preventing the accumulation of dust in bearings will be emphasized. Frank Brauer, chief draftsman, Watertown Arsenal, Watertown, Mass., will present a paper on "Anti-friction Bearings in Ordnance Work." This paper will show how rapid and easy manipulation of heavy ordnance has been made possible by the use of ball and roller bearings, and will present some designs for heavy load conditions.

New Shop Equipment at the Expositions

This Section Includes only Machines and Tools that have not Previously been Described

FOOTE-BURT BROACHING MACHINE

Cleveland Exposition, Booth No. 526

A new method of finishing flat or irregular surfaces by broaching is made possible by a machine brought out by the Foote-Burt Co., Cleveland, Ohio. With this machine one or more surfaces are roughed and finished in one operation. The finish is of a high quality, and dimensions can be held to unusually close limits.

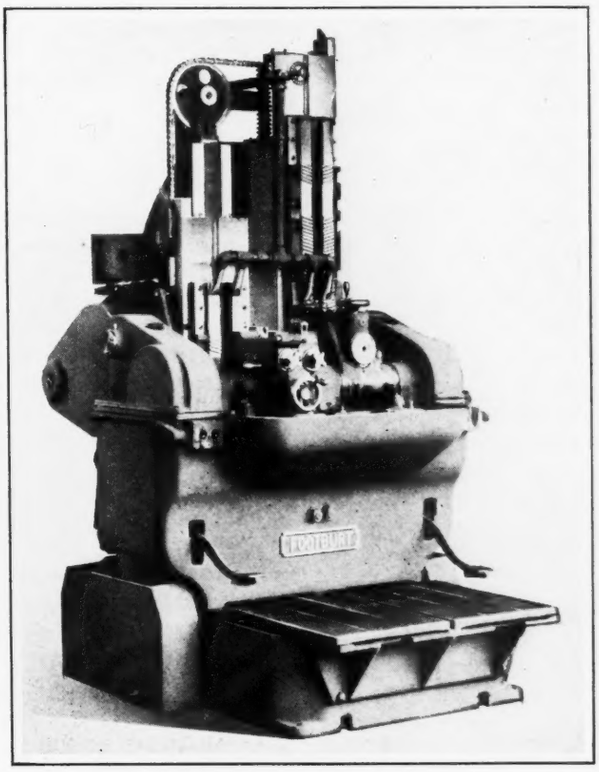
As an example of work for which this machine is adapted may be mentioned the broaching of both sides of the two bosses—four surfaces in all—on an automobile front steering spindle connecting-rod yoke. These pieces are handled by one operator and one machine at the rate of 600 per hour. The two flat surfaces on automobile steering knuckles that receive the dust cover for the front wheel brake are broached at the rate of 120 pieces per hour. The accompanying illustration shows the machine equipped for this job. While the production mentioned is high, it could still be increased, were it possible for one operator to load and unload work at a faster rate.

The lower teeth on the broach rough the work, and the upper teeth take a light finishing cut. This increases the life of the finishing teeth. The broaches are solidly supported directly behind the cutting edges, which also has a tendency to preserve the broaches, permits greater accuracy in operation and produces a higher finish on the work.

The machine consists of a base with two uprights. Cases holding the broaches are bolted to slides which operate alternately up and down on the ways of the uprights. A 17-horsepower elevator-type reversing motor furnishes power through gearing to the driving pinion which is located between the two slides and meshes with hardened steel racks on the slides. The slides counterbalance each other, as one moves up when the other moves down. They operate continually, at a speed predetermined by the nature of the work.

In front of each slide is a "tip-up" fixture for holding the work. When the slide is at the bottom of the stroke, the fixture is in a horizontal position, and the piece to be machined is placed in it while the slide moves up. When the piece is in place, a lever is tripped, and —provided the lever is operated before the slide reaches the top of the stroke—the fixture is automatically tipped to an upright position. Then the slide moves down and the piece is broached, the fixture being automatically thrown back into the horizontal position for unloading and reloading. If the trip-lever is not operated before the slide reaches the top of the stroke, the fixture will not be tipped up until the next cycle.

The entire base of the machine is used as a tank for coolant. Its capacity is 60 gallons. The pump delivers the coolant to the work at the rate of 40 gallons per minute.



"Footburt" Broaching Machine of Unusual Design

NORTON GRINDING MACHINES

Cleveland Exposition, Booth No. 202

Two grinding machines—a full automatic and a heavy-duty cylindrical grinder—and an automatic indexing cam-grinding attachment have been brought out by the Norton Co., Worcester, Mass.

The full automatic grinding machine, shown in Fig. 1, is known as the type B. This machine has a capacity for diameters up to 4 inches and lengths up to 5 inches. The concentricity of the ground surface with the hole or with other diameters on the piece is assured through the location of the work on centers, the work being placed in a feeder and then delivered between the driving centers by a mechanically operated loader of the turret type. The illustration shows the machine without the work-loading fixture. End pressure, adjusted to the requirements, drives the work. Upon completion of the grinding cut and dwell, the centers are withdrawn to permit the turret to remove the finished part and insert the next for grinding. The machine can be arranged with a length of cycle to suit any operation.

The wheel unit used is the regular Norton 10-inch type B. The wheel feed is linked with the automatic controls and timed with the operating cycle. A positive gear drive and cam actions control the cycle from the automatic loading of the work to its ejection. The revolutions of the

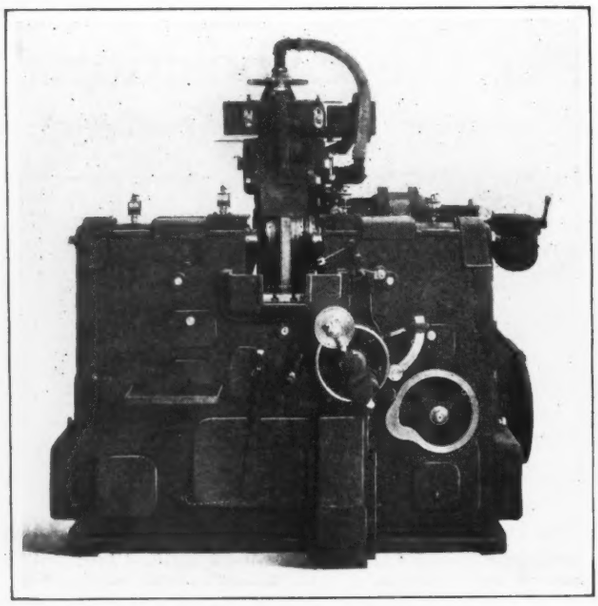


Fig. 1. Norton Full Automatic Grinding Machine

work and the rate of wheel in-feed are timed to suit each job. The length of dwell at the end of the cut can be changed according to the requirements.

The wheel truing device is in the wheel guard, and is provided with a power traverse motion. Formed surfaces may be ground by truing the wheel face accordingly. This is done by using a form bar in the truing device to control the path of the diamond. On straight work the use of a wheel-spindle reciprocating attachment preserves the life of the wheel face and improves the finish produced. Several full automatics may be tended by a helper after they have once been set up for a job.

The heavy-duty cylindrical grinding machine mentioned is known as the 14-inch type BA. It is intended to handle that class of wide-wheel straight-in cut grinding work too heavy for ordinary grinding machines. The machine swings 14 inches, and has a wheel width of 15 inches. In principle, the machine is of the Norton type BA construction with the features of the 10-inch type B grinding wheel unit. All dimensions, however, have been increased over the 10-inch size. It is made in various lengths.

The machine is arranged for a self-contained motor drive, using a 30-horsepower constant-speed motor for the main drive and a 2-horsepower adjustable-speed motor for the headstock. The main drive is from the motor mounted on the rear of the machine through an endless belt 9 inches wide to the power shaft in the wheel unit base, from which, in turn, the wheel-spindle is driven by another 9-inch endless belt.

Twenty different in-feed speeds are provided. At the predetermined size, the feed is automatically stopped. Compensation for wheel wear is conveniently made by movement of the index in increments of 0.00025 inch on the work diameter.

A wheel-spindle reciprocating attachment can be applied for slowly moving the wheel back and forth in the direction of its axis, the object being to improve the finish obtained and increase the number of pieces for each wheel truing. The weight of the machine in the 24-inch length without motors is approximately 11,800 pounds, and with motors, 13,300 pounds.

The automatic indexing cam-grinding attachment may be applied to Norton types A and BA cylindrical grinding machines when grinding cams integral with the shaft. But two manual operations are required at each indexing of the shaft—

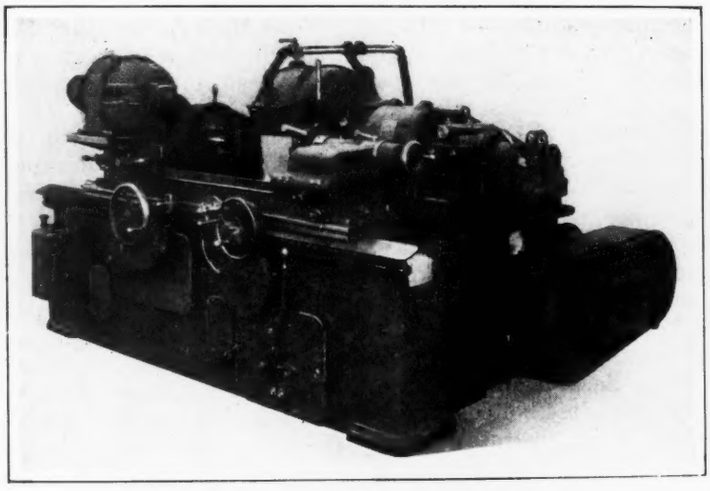


Fig. 3. Heavy-duty Cylindrical Grinding Machine

the backing off of the wheel index and the hand traverse of the table to bring the next cam into position in front of the wheel. Pneumatic and mechanical controls cause automatic movement of the rocking bar and master cam roll.

In operation, the wheel feed index is backed a short turn at the end of the grinding cut, which action, through the automatic control, also rocks the camshaft forward from the wheel. It is then possible to move the table to bring the next cam in front of the wheel. The traverse of the table automatically brings the master cam roller up to the master cam for the cam now in front of the wheel. When the wheel is again fed toward the shaft, the rocking bar is released to give contact between the master cam and roller. The feed is continued to the index-stop to bring the cam to size, completing the grinding cycle for that cut.

This automatic attachment can be applied to present cam grinding machines by substituting the parts linked with the automatic operation for those of the hand controlled fixture.

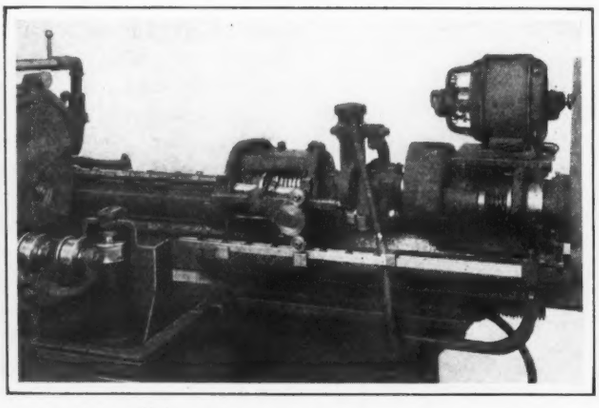


Fig. 2. Automatic Indexing Cam-grinding Attachment

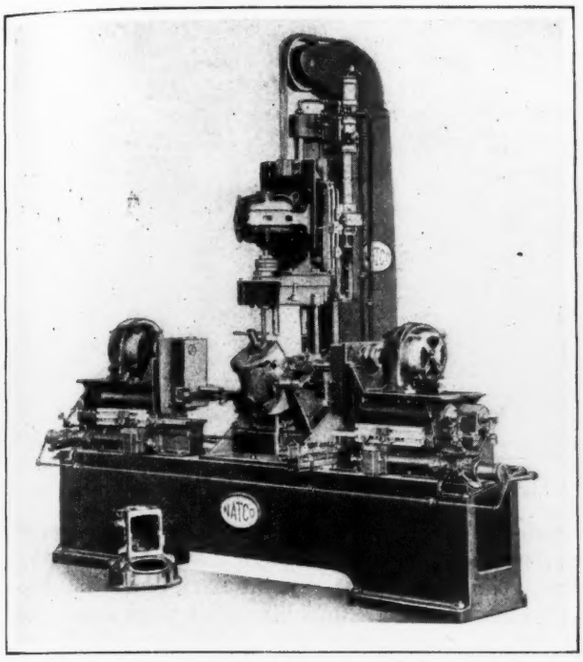


Fig. 1. Machine with Three "Natco" Drilling Units

"NATCO" HYDRAULIC-FEED DRILLING UNIT

Cleveland Exposition, Booth No. 412

A newly developed unit has been added to the hydraulic-feed drilling equipment manufactured by the National Automatic Tool Co., Richmond, Ind. This unit, which is known as a "4-inch sliding head" is shown in Fig. 2. Complete machines of various types may be built up of several units, a typical machine being shown in Fig. 1.

Each unit, with a motor and spindle box, is a complete drilling machine when attached to a supply pump. Individual feed-control valves operated by adjustable trip-dogs completely govern the head movements. All units on one machine are started simultaneously from a single valve at the operator's position, after which the units automatically go through the complete cycle of rapid forward, slow feed, rapid return, and stop. The valve also serves as an emergency reverse. The maximum head travel is 11 inches. The travel and feed, however, can be limited by means of trip-dogs, to suit the job.

To conserve space and piping, the hydraulic cylinder is cast in the head slide, and the feeding pressure for both forward and reverse enters through the center of the piston shaft. Each unit will drive two 1-inch diameter drills at a 0.010 inch feed in cast iron or the equivalent. The feed can be set from zero to the rapid traverse rate of approximately 75 inches per minute. A three-horsepower motor is recommended for capacity drilling.

The three-way machine illustrated is arranged for drilling three sides of transmission cases at the rate of 90 per hour.

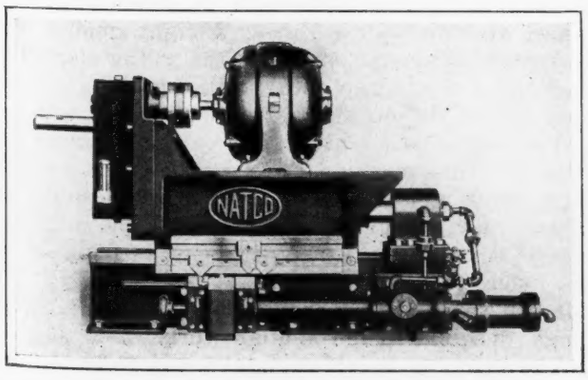


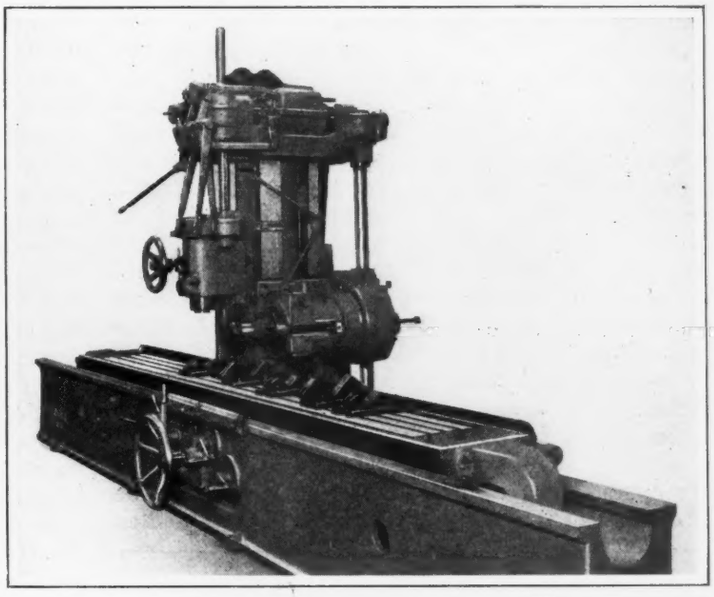
Fig. 2. "Natco" 4-inch Hydraulic-feed Drilling Unit

INGERSOLL KEYWAY MILLING MACHINE

Cleveland Exposition, Booth No. 413

The two-spindle keyway milling machine here illustrated has been developed by the Ingersoll Milling Machine Co., Rockford, Ill., for use when keyways have to be cut in shafts of a wide variety of sizes. The machine has a capacity for shafts from 1 1/2 to 18 inches in diameter. The horizontal saddle is a heavy milling-machine saddle for the arbor-milling of long keyways. The vertical spindle routs the ends and end-mills short keyways and tool slots.

The table is 18 inches wide by 12 feet long. V-block fixtures can be supplied to center the work and reduce the loading time. The vertical spindle is centered over the fixtures, and requires no horizontal adjustment. Special cutters are provided for the horizontal spindle, with the over-all thickness made to close limits, so that when a cutter has once been set to line up with the vertical spindle, the horizontal spindle may be used on any width of keyway without resetting, by merely changing the cutters.



Ingersoll Two-spindle Keyway Milling Machine

Either head is quickly brought into use, while the other is as quickly run up out of the way. The horizontal head has a power vertical feed and a quick adjustment, the feed being used for milling key slots in spindle noses and similar work. High feeds can be used with the horizontal spindle, limited by the finish desired. A good finish suitable for sliding keys can be obtained with the 6-inch feed, and for tight keys the feed can often be doubled. All control levers are at the front of the

machine within easy reach of the operator. Scales are attached to the table and housing to assist in making rough settings, while dial indicators make it possible to obtain accurate settings.

Two other milling machines of new design will also be shown at the Cleveland exposition. One is a 66-inch by 48-inch by 16-foot, four-head heavy-pattern adjustable rail milling machine, and the other, a 42-inch by 36-inch by 12-foot standard-pattern adjustable rail milling machine. While these follow the general lines of Ingersoll design, many special refinements are introduced which will prove new to the visitors at the exposition.

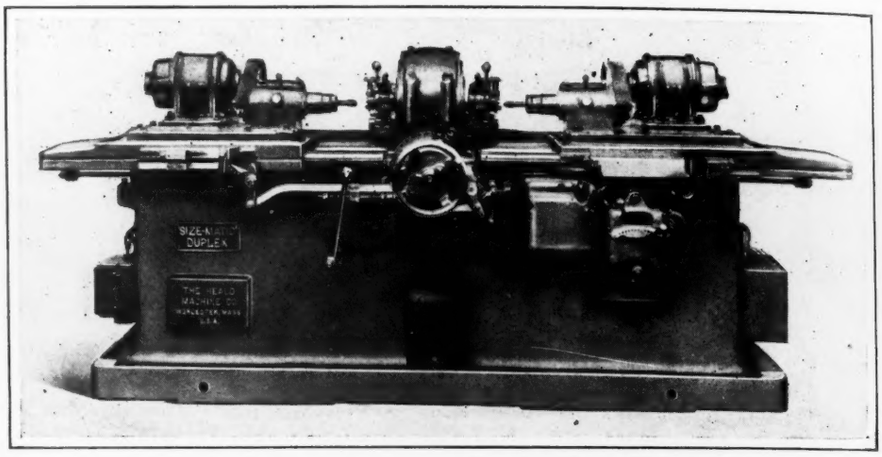


Fig. 2. Duplex "Size-Matic" Machine for Grinding Opposite Holes Simultaneously

HEALD GRINDING MACHINES

Cleveland Exposition, Booth No. 611

Three new machines, a "Size-Matic" internal grinder for short work, a "Size-Matic" duplex grinder, and a large size rotary surface grinder have recently been put on the market by the Heald Machine Co., Worcester, Mass.

The line of style No. 72 internal grinding machines, including the plain, semi-automatic, and "Size-Matic" types, has been redesigned and is now known as line No. 72A. To this line has been added the No. 72A-2 "Size-Matic" machine for handling short work not over 2 inches in length, such as ball races, gears, and rings. This machine is of the same design as the larger redesigned style No. 72A-3 "Size-Matic" shown in Fig. 1. Either a belt or full motor drive can be used. The base has been redesigned and slight improvements made in working parts.

The drive of two-motor machines has been simplified. The back-shaft motor has a double-end armature shaft. On one end of this shaft there is a pulley for driving the work-head, and on the other end, a coupling which is connected with the oil-pump. This coupling also serves as a pulley for driving the water pump and as a sprocket for driving the generator through a silent chain. With this arrangement, the regular back-shaft employed on the earlier No. 72 machines has been eliminated. The wheel-head motor drive is the same as before. On machines driven by three motors, the motor at the rear has a single-end shaft.

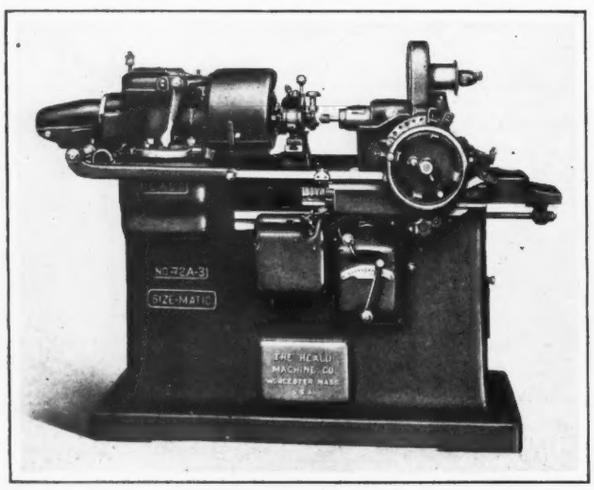


Fig. 1. Heald Improved "Size-Matic" Grinder

The slow-down valve and diamond control has also been simplified, and its position changed to the right-hand end of the rear of the base, where it is well protected from water and dirt, but can be easily adjusted.

The new "Size-Matic" duplex internal grinding machine is shown in Fig. 2. This machine handles work that requires the grinding of two opposite holes in accurate alignment, such as wrist-pin holes in pistons, holes in cluster gears, and other work where the opposite holes are about the same size in diameter and length. Independent size control is provided for each hole. The machine is fully automatic in regard to speeds, feeds, truing of the wheel, and sizing of the work. The two main tables which carry the wheel-heads have no crosswise movement. They are hydraulically driven with a single control, and their movements are synchronized through mechanical connections.

Special fixtures are inserted in the hole of the work-head spindle, which is approximately 7 1/4 inches in diameter by 10 inches long. The work-head is located on the cross-slide, which is provided with automatically operated coarse and fine feeds. An electrical arrangement lifts a pawl, which allows the tables to go to the rest position when the work has been ground to size. The cross-slide is also provided with an automatic arrangement which advances it sufficiently to compensate for wheel wear and to insure that a slight amount will be removed from the wheels by the truing diamonds each time they drop into position, which occurs just before the finished size is reached.

The new surface grinder No. 25A is shown in Fig. 3. This machine has been brought out for large work which must be held within close limits of accuracy and given a fine finish. The machine can be equipped with magnetic chucks from 16 to 30 inches in diameter. It is particularly well adapted for grinding such parts as Diesel engine rings, dies, saws, and similar work.

The machine is self-contained and fully motor-driven; a variable-speed motor drives the chuck,

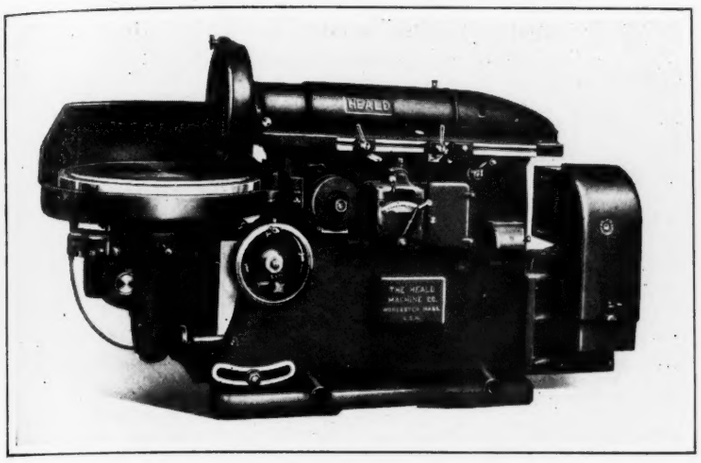


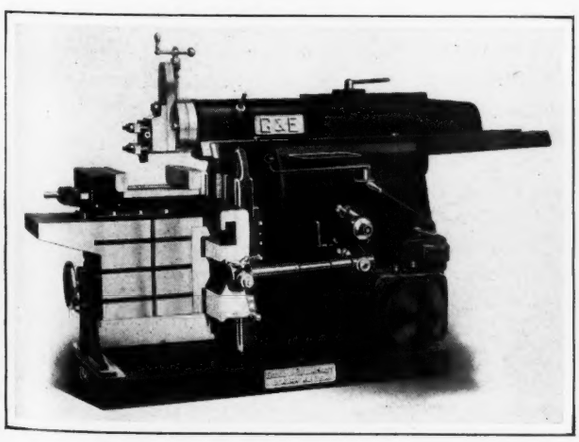
Fig. 3. Large-sized Rotary Surface Grinder

which is started and stopped by a push-button control. There is also a dynamic brake. An unlimited number of speeds for the wheel-slide, ranging from maximum to minimum, is obtainable with a hydraulically operated reciprocating mechanism. All chucks up to and including the 24-inch size can be equipped with a micrometer adjustment for the truing diamond, which furnishes a means for automatically holding duplicate work to uniform thicknesses. The main drive shaft is mounted in ball bearings and receives power from a constant-speed direct-connected motor.

GOULD & EBERHARDT SHAPER

Cleveland Exposition, Booth No. 328

A shaper of the manufacturing type, combining unusual strength and rigidity with speed and power, has been brought out by Gould & Eberhardt, Newark, N. J., for handling work on a production basis. This shaper, as shown in the accompanying illustration, has a number of features especially adapting it for manufacturing purposes, as follows: Single-cam power feed; dual control for table hand feed; power rapid traverse to table; double crank gear; heat-treated gears throughout; circulating pressure oiling; anti-friction bearings; rigid and symmetrical frame; chilled ram guide ways; work-table guide ways designed to hold firmly and guide accurately; metal-to-metal clamp for rail to frame; direct-coupled motor; non-slip table support; and production vise.



Gould & Eberhardt Shaper of the Manufacturing Type

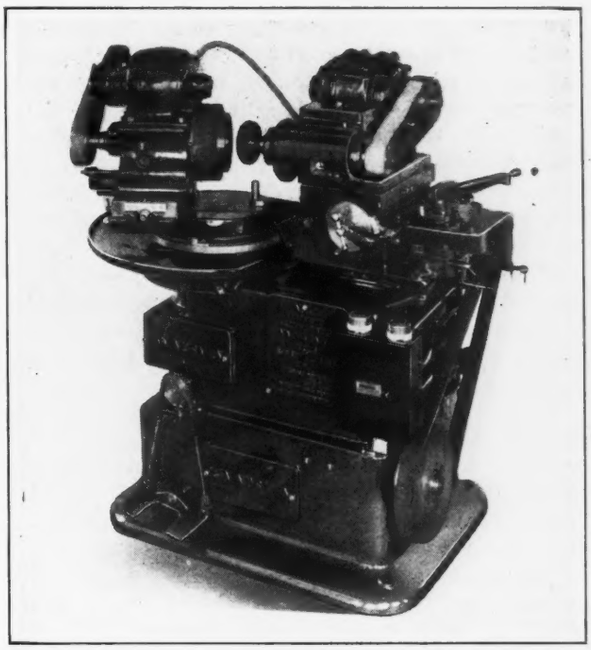
VAN NORMAN OSCILLATING GRINDER

Cleveland Exposition, Booth No. 728

The No. 42 oscillating grinder or oscillator built by the Van Norman Machine Tool Co., Springfield, Mass., is primarily intended for grinding the ball raceway in large-sized ball bearing outer rings within the maximum work-head swing of 16 inches. A unit motor drive is provided for each separate function of the machine. The work-head is supported for oscillation on a wide conical bearing, in addition to ball bearings at both the upper and lower ends of the vertical oscillating post. The motor for driving the work-spindle is carried by and is movable with the work-head.

The wheel-head is of the block type and bored to receive a quill type wheel-spindle assembly. The motor for the wheel-spindle is adjustably mounted on and is movable with the wheel-head.

The motor for driving the automatic cross-feed of the wheel-spindle and the automatic oscillation



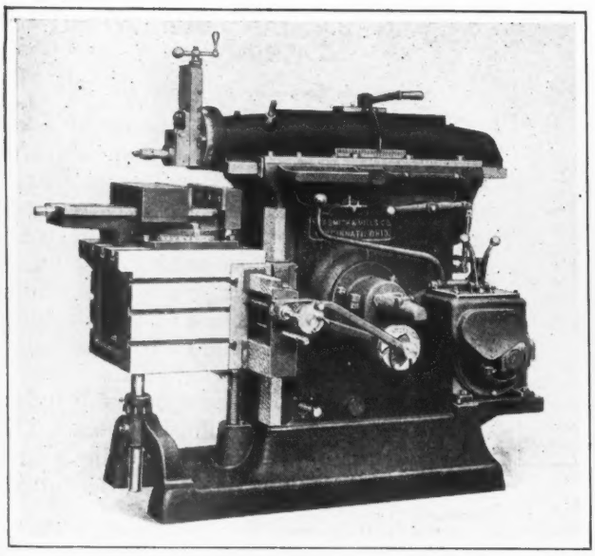
Van Norman Grinder with Oscillating Work-head

of the work-head is adjustably mounted at the rear of the machine and is belt-connected to a shaft which engages the mechanism within the body of the machine through a worm and worm-gear. The machine is also readily adaptable for radius-grinding of work other than ball bearings.

SMITH & MILLS CRANK SHAPER

Cleveland Exposition, Booth No. 110

Important improvements have been made in the 16-, 20-, and 25-inch sizes of the back-geared heavy-duty crank shaper built by the Smith & Mills Co., 2889-91 Spring Grove Ave., Cincinnati, Ohio. The 25-inch shaper, which will be exhibited, is arranged for a 7 1/2-horsepower General Electric motor drive through a speed-box, with a push-button con-



Smith & Mills Back-geared Crank Shaper

trol. The shaper may also be belt-driven through a cone pulley or a single pulley and speed-box. Eight different cutting speeds are provided through the speed-box and back-geared drive, the changes being made by two levers within easy reach of the operator. The drive is transmitted through a twin disk clutch. The clutch and a self-acting brake are controlled by a single ball lever.

All gears in the speed box and column, except the main gear, are of the cluster type, and have teeth which are machine-rounded to facilitate meshing. Sliding gears slide on multiple-spline shafts, the shafts in the speed box being mounted on Timken tapered roller bearings. There is an internal ratchet feed with parts enclosed inside the feed gear. A solid feed-rod is provided with a graduated disk. The jaw type vise has a graduated swivel base.

A one-shot lubricator supplies fresh oil to all main bearings and ramways and to parts on the inside of the machine. The system includes two distributing units having twelve outlets, a foot-operated plunger being outside of the machine within easy reach of the operator.

The shaper can be equipped with an automatic vertical feed to the tool, revolving table, tilting table top, index-centers, and various other attachments.

LE BLOND CRANKSHAFT LATHE

Cleveland Exposition, Booth No. 721

A center-drive automatic crankshaft lathe has been brought out by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. This machine turns the stub- and flange-end bearings of crankshafts simultaneously, instead of using separate machines for these end-bearings —one for the stub-end bearing and one for the flange-end bearing. The center driving head makes possible the machining of the two end-bearings simultaneously. Front and rear tools feed together simultaneously and machine the bearings to the rough-grinding size. The machine is provided with an air-operated loading device, which greatly simplifies the work of placing the crankshaft between centers.

DIAMOND GRINDING MACHINES

Cleveland Exposition, Booth No. 711

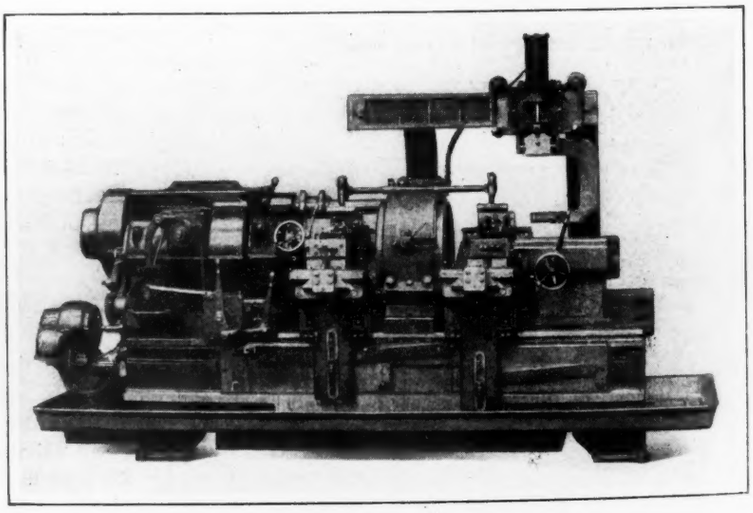
Two new grinding machines built by the Diamond Machine Co., 9 Codding St., Providence, R. I., will be shown at the Cleveland Exposition. One of the machines is a face grinder, which constitutes an improvement on the former belt-driven machine built by the company in that it is hydraulically operated through an oil-pump, rack, and pinion. This design increases the ease of operation and allows an unlimited number of table speeds up to a maximum of 72 feet per minute. The table travel may be varied to suit any particular work, but the general plan of relatively low spindle speeds and fast table travel is recommended, as giving the best and most economical results.

The other new machine is a hydraulically operated surface grinder. This machine is operated through an oil-pump and cylinder, and in addition, is designed to grind either on the periphery of a disk wheel or on the face of a cup-wheel. By a simple adjustment, the abrasive wheel may be set to grind at any angle between the vertical and the horizontal. This feature enables the grinding of V-ways and similar surfaces that would otherwise have to be machined and scraped.

W. F. & JOHN BARNES MULTIPLE-SPINDLE DUPLEX BORING MACHINE

Cleveland Exposition, Booth No. 1027

The W. F. & John Barnes Co., Rockford, Ill., has recently completed two horizontal duplex type heavy-duty multiple-spindle production boring machines for a prominent maker of motor car accessories. One of these machines is shown in Figs. 1 and 2. The head at the left-hand end of the machine, Fig. 1, contains ten spindles in five groups of two each, and the head at the right-hand side, four spindles in groups of two each. The spindles are mounted in Timken tapered roller



LeBlond Center-drive Automatic Crankshaft Lathe

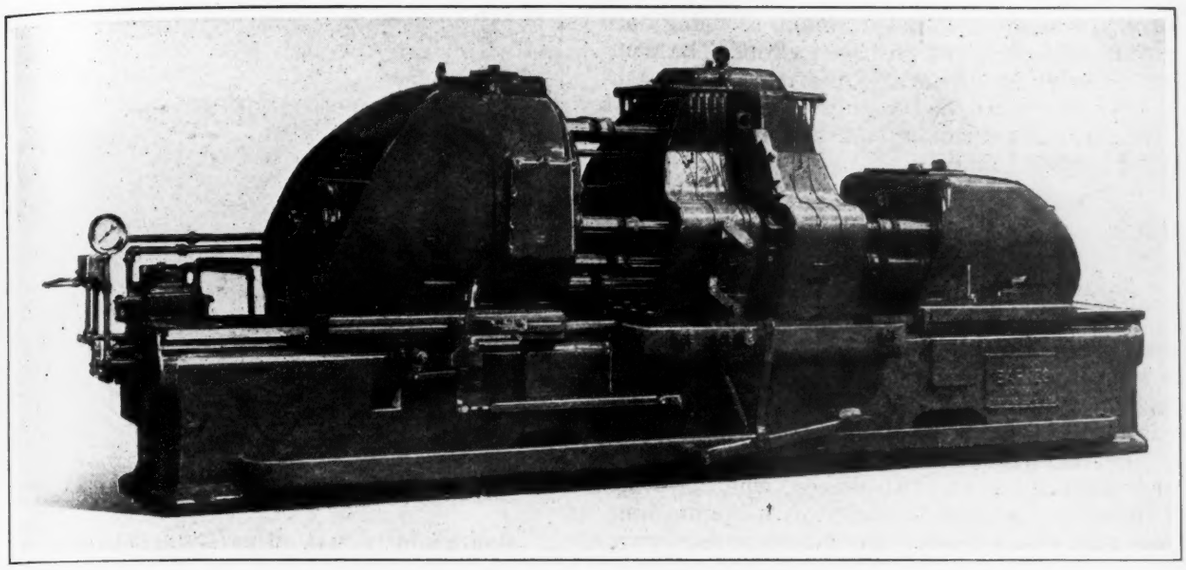


Fig. 1. Front View of W. F. & John Barnes Multiple-spindle Boring Machine

bearings and are driven by hardened steel gears. Both the spindle bearings and the gears are oiled by splash lubrication and a cascade oiling system supplied by a gear pump connected with a supply tank on the back of the machine head. The nose of each spindle can be adjusted to provide for accurate tool setting and to compensate for the grinding of tools. The machine can be used for different kinds of work without making any basic changes in its construction, by replacing the accurately fitted heads with types designed to meet requirements.

The spindle drive is by individual motors mounted on the rear of each head. Standard commercial squirrel-cage motors customarily used for driving machine tools are employed. This type of motor has the advantage that, should it fail in operation, it can be removed quickly and replaced by another motor from stock.

In the center of the cast semi-steel bed is a large chip pan. A wide coolant trough cast integral with the bed extends along each side for practically the entire length of the machine. The machine bed is closed at the bottom to form the coolant sump or reservoir.

The feed is through an Oilgear type QH full-automatic pump, a driving motor for this equipment being mounted on the back of the machine base. The pressure gage and some of the piping of the Oilgear feed equipment may be seen at the left-hand end of the machine in Fig. 1. The operating cycle of this particular machine is rapid traverse forward; automatic trip to slow feed for drilling, boring and hollow milling; automatic trip to slower feed for facing; and automatic quick return.

This cycle of operations takes place automatically after the operator trips the feed by hand-lever which starts the forward movement of the heads. Two pieces are completed at each cycle, and since the operator is loading and unloading while the machine is in operation, only the time of indexing and traversing the head to and away from the work is non-productive. The flexible adjustment of the Oilgear mechanism permits any desired rate of feed to be obtained.

In order to conserve floor space, the one Oilgear cylinder which feeds both heads simultaneously through rack and pinion arrangements is enclosed in the bed. The work for which this machine was designed includes simultaneously drilling, boring, hollow milling, box milling, line reaming, chamfering, and facing to accurate depths.

The six-station trunnion fixture provides for loading two castings in each station. In Fig. 2, the operator is shown loading one of the stations at the front while the other five stations are operative. The guide bushings for the tools are long and of as large diameter as the tools will allow. Liner bushings of hardened steel are pressed into bosses in the castings, which act as bushing plates and trunnion supports, and slip bushings fitting in these liners are used to guide the tools.

The over-arm of the fixture ties the trunnion supports together and furnishes an oil reservoir from which leads controlled by sight-feed oilers supply lubrication to each bushing and to the trunnion bearings. Two lock-pins, operated simultaneously by a foot-lever at the front of the machine,

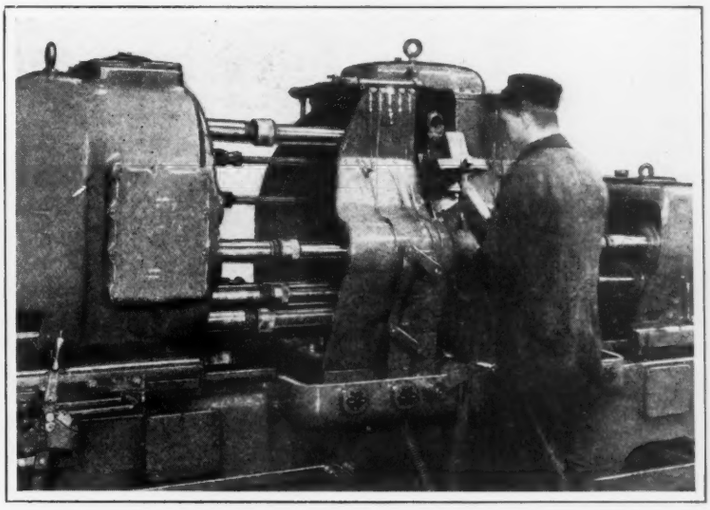


Fig. 2. Loading One of the Stations on Machine Shown in Fig. 1

control the rotation of the trunnion, assuring both accurate alignment and positive locking. The trunnion diameter is 9 inches. Dust rings and washers serve to protect the bearings. The total weight of the machine, including the motors, is approximately 18,000 pounds.

CINCINNATI GEAR BURNISHING MACHINE

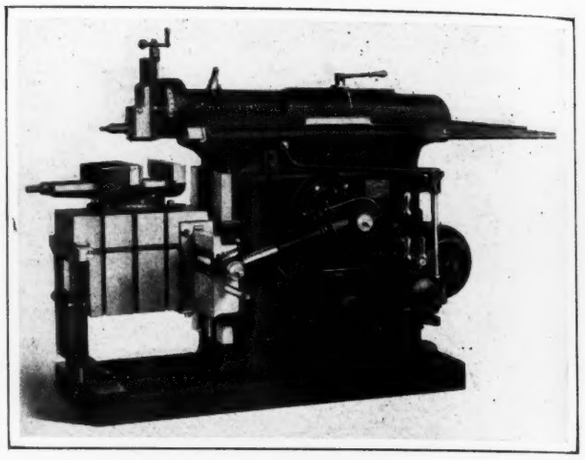
Cleveland Exposition, Booth No. 317

A gear burnishing machine brought out by the Cincinnati Shaper Co., Elam St. and Garrard Ave., Cincinnati, Ohio, is shown in the accompanying illustration with the carriage in the loading position. Bringing down the lever, moves the carriage up into the working position. In operation, the machine requires three arbors and three master gears, one driving and two driven, which are not shown, as they are not furnished with the machine unless specially ordered. The machine, as shown, has solid bearings for the carriage arbors. Either bronze bushings or ball bearings can be furnished.

The machine operates automatically. The operator places the gear in position between the master gears and pushes the lever down, which brings the gear into engagement with the driving burnishing gear. Throwing the control switch, starts the machine in the forward direction, and after it has made a predetermined number of revolutions (adjustable by dogs), the spindle reverses and makes the same number of revolutions in the opposite direction. Then it stops automatically.

The pressure with which the gear engages the burnishing gear is adjusted by raising the whole carriage by means of a crank. A micrometer collar is provided for fine adjustment. The carriage can be locked in place or left free. In the latter case, constant pressure is maintained on the gears by a counterweight. The Cincinnati power rapid-traverse shaper shown in August MACHINERY, will also be exhibited at Cleveland.

Cincinnati Gear Burnishing Machine



Shaper Built by the Rockford Machine Tool Co.

ROCKFORD "HY-SERVICE" SHAPER

Cleveland Exposition, Booth No. 119

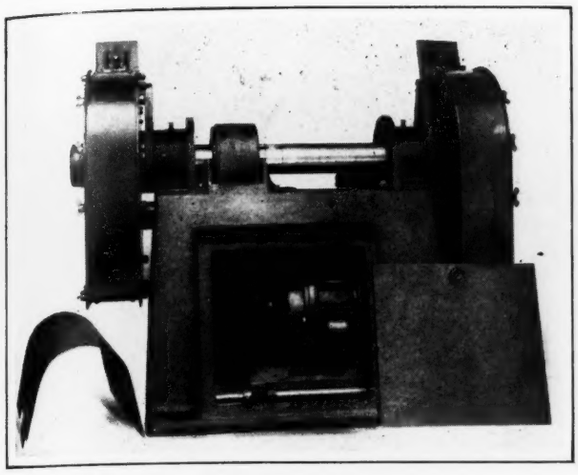
A "Hy-Service" crank shaper, built in six sizes —16-, 20- and 24-inch heavy, and 20-, 24- and 28-inch standard—has been brought out by the Rockford Machine Tool Co., 2400 Kishwaukee Rd., Rockford, Ill. All gears in this machine are made of alloy steel, with the transmission gears heat-treated. The machine may be equipped for either an individual motor drive or single-pulley belt drive. It has Timken roller bearings throughout. Forced lubrication is provided for all bearings, for the ram ways, and for all members of the rocker arm mechanism; and a perforated pipe maintains a constant shower of oil over the transmission gears.

The ram speeds and feeds are arranged in geometrical progression. The range of cutting strokes is from 10 to 124 per minute, and the range of table feeds, from 0.008 to 0.104 inch per stroke. Feeding is accomplished by a drum or track cam, which assures a positive movement. A safety device protects the mechanism in case some unexpected obstruction interrupts the feeding movement. The drive is equipped with a "Twin-disc" clutch, furnished with a brake mechanism for instantly stopping the machine if desired. The bull gear and pinion have helical teeth and the bull gear is counterbalanced to eliminate shock or vibration.

RANSOM GRINDING MACHINE

Cleveland Exposition, Booth No. 818

A new grinding machine with a motor in the base, as shown in the accompanying illustration, has recently been placed on the market by the Ransom Mfg. Co., Oshkosh, Wis. This new machine is of the same general design as the RW type made by this company, but is of much heavier construction and operates wheels up to a maximum of 10,000 surface feet per minute. The new No. 74 HS machine is equipped with a 15-horsepower ball-bearing motor. Two 24-inch by 3-inch rubber or bakelite bond wheels can be mounted on the spindle, which is 4 1/2 inches in diameter between the bearings. Flanges either 12 or 20 inches in diameter may be used as desired. The distance



Ransom Grinding Machine with Motor in the Base

between the grinding wheels is 49 inches, and the height from the floor to the center of the arbor, 35 inches. The machine weighs 3200 pounds.

SELLERS TYPE K PLANER

Cleveland Exposition, Booth No. 211

A new 36-inch by 36-inch type K planer, built by William Sellers & Co., Inc., Philadelphia, Pa., will be exhibited in Cleveland. This planer combines the established basic principles of Sellers planers with improvements in power traverse, dial feed, centralized lubrication, and single-lever crosshead locking device, as well as improved minor features. The bed is of box-type construction with one flat and one "double-V" way.

The planer is provided with the Sellers type of drive, having but one shaft running through the bed and but one gear—the spiral pinion—located between the ways. The drive is by a reversing motor located on the right-hand side of the machine, toward the rear, and well out of the way of the operator. There is one reduction between the motor and the main driving shaft, consisting of a steel herringbone gear and pinion running in oil.

The table is of deep box construction. The rack is separate from the table, made in sections, and fastened to the table by clamps. One end of the rack abuts against a solid stop on the table. The cross-rail is of the extended-back type, and of box construction between the uprights. It is clamped by means of a single lever. Power traverse is provided for all heads. One head may be traversed while another is feeding. Auxiliary motors furnish the power for the feed and traverse of heads and the lift of the cross-rail; and a small motor drives a pump for lubricating the ways.

MOLINE HYDRAULIC DRILLER

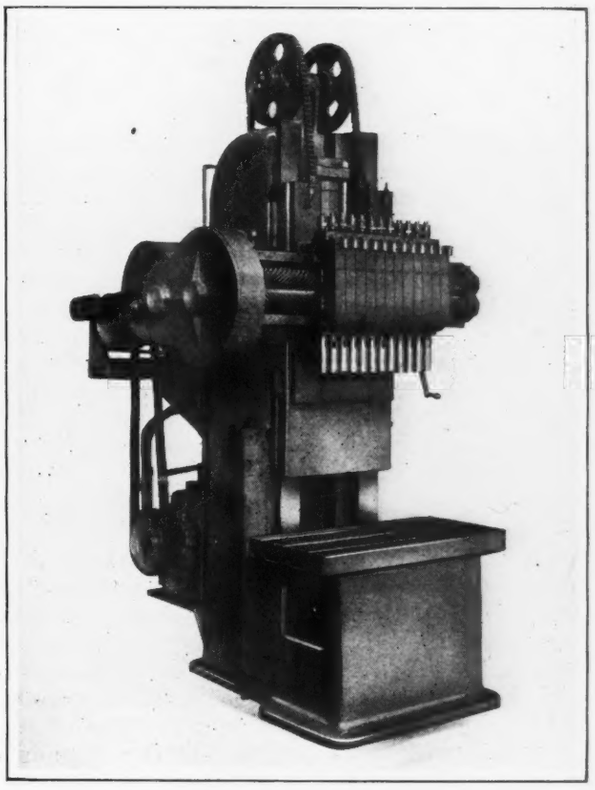
Cleveland Exposition, Booth No. 1021

A new driller known as the 115-D has recently been added to the line of "Hole Hog" machines made by the Moline Tool Co., Moline, Ill. This machine has been built to supersede several different sizes and types of the present line, particularly those machines now being used for various valve machining operations. The column has guides extending the full length, and is provided with wings to which the base is bolted. The base is made U-shaped to provide clearance for the slide. The slide has a narrow guide on the column, and is held by tapered gibs which permit easy and positive adjustment. The rail that carries the spiral driving shafts and the spindle heads is bolted to the slide and can be placed at varying heights with respect to the table.

The machine is driven by a motor connected by a belt to a pulley on an auxiliary shaft mounted on the rail, an idler pulley maintaining belt tension as the rail travels up and down. Pick-off gears in the gear-case provide changes in speed. An Oilgear feed pump, made especially for drilling machines, is also operated by the motor that drives the machine. A 5 1/8- by 24-inch cylinder mounted on the front and center of the column is inverted so that it gives the greatest pressure on the working stroke. Feeds may be varied by simply turning the control handle of a small valve.

The stroke is controlled by a single lever at the right of the machine, the cycle of operations being carried out automatically. The operator shifts the lever to start the quick approach movement. Properly set stops automatically shift the lever into position for the slow feed movement and into the reverse position after the work has been completed, finally stopping the machine at the top of the stroke. The illustration shows a machine equipped with twelve 2-inch heads on the rail, but any BV type of head or special heads can be applied to meet center distance requirements.

The minimum center distance obtainable with the 2-inch head is 2 inches, and the maximum center distance, 40 inches. The travel of the rail is 24 inches. The maximum distance from the table to the bottom way of the rail is 44 inches, and the minimum, 4 inches. A motor of 7 1/2 to 15 horsepower is required.



Moline 36-inch Hydraulic Driller

GARDNER SURFACE AND DISK GRINDERS

Cleveland Exposition, Booth No. 420

A surface grinder equipped with two hydraulically actuated work-tables and one head for two abrasive cutting wheels, and a mechanically oscillating work-table for disk grinders have recently been brought out by the Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.

The hydraulic surface grinder, which is designated as the No. 89, is shown in Fig. 1. It is adapted for grinding flat surfaces on a variety of parts, being well suited for grinding two or more surfaces that are in such relation to each other that they cannot be readily finished simultaneously. The two hydraulically controlled tables can be served by one operator, or one operator can be employed at each table. All movements of the tables are predetermined, and each table is controlled, after being set up, by a hand-lever. Micrometer stop adjustments control the various traverses, and the tables can be operated simultaneously or alternately.

The abrasive wheel spindle is equipped with ball bearings, the thrust and radial loads being taken

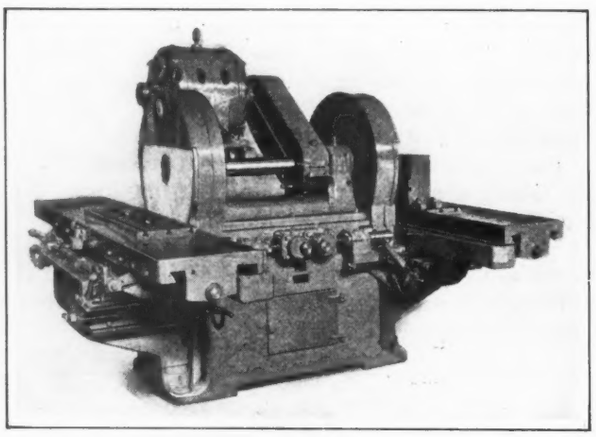


Fig. 1. Gardner Hydraulic Surface Grinder

by separate bearings. The drive is either by belt from a countershaft or by a motor through a silent chain and sprockets enclosed in an oil-tight dust-proof case. When equipped for a belt drive, both the spindle and the hydraulic power units are driven from one countershaft, but when motor-driven, a 25-horsepower motor drives the spindle and a 5-horsepower motor the hydraulic pumps. The abrasive members consist of either 30-inch steel disk wheels faced with heavy Gardner G.I.A. disks, or 24-inch chucks carrying ring wheels. The abrasive members are, of course, mounted on opposite ends of the spindle.

Two mechanically oscillating work-tables are shown in Fig. 2 applied to a Gardner No. 7 1/2 standard grinder. Each table is connected to a worm-gear mechanism at the rear of the machine base, which is driven either by an individual motor or by belt from the countershaft. A gear-box contains the required reduction gears. In operation, the table rocks or oscillates automatically, causing the work to pass across the face of the grinding member several times, and thus eliminating entirely the hand labor ordinarily required.

The work is fed up to the grinding member by

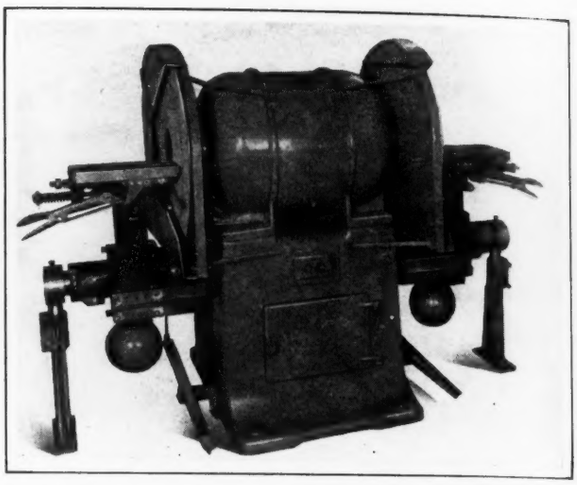


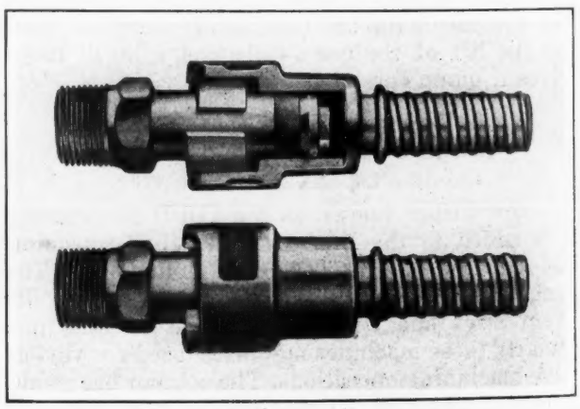
Fig. 2. Grinder with Oscillating Work-tables

spring tension, which may be adjusted to suit the area of the surface being ground. Connecting links can be adjusted to vary the length of the table travel across the wheel. The rocking mechanism can be quickly disengaged by applying pressure on the foot-treadle, and the table is then tilted forward into the loading position. To return the table to the grinding position, the operator simply lifts a lever to engage the rocking mechanism and cause the oscillating motion to be resumed. The oscillating work-table is built for 20-, 26-, 30-, and 40-inch hand-operated single-spindle disk grinders. It may be readily applied to the Nos. 4, 6, 7, 7 1/2, 8, and 50 grinders built by the company.

ROBINSON AIR-HOSE COUPLING

Cleveland Exposition, Booth No. A-7

A plain type air-hose coupling, styled "Superior," is now manufactured by the Robinson Machine Co., Muskegon, Mich. This coupling is connected and disconnected by a one-quarter turn. It has no springs or loose parts. A specially treated leather gasket is expanded by a V-shaped ring when air pressure is applied. This gives a pressure-seated air-hose coupling that is air-tight under any pressure conditions. The gasket cannot pull out of the coupling, nor will it stick or corrode. When the gasket shows any wear, a slight turn of the nut on the end of the male half will readjust it. The coupling is made interchangeable in 3/8-, 1/2-, and 3/4-inch sizes for pipe and hose lines.



Robinson Plain Type Air Hose Coupling

HALL THREAD MILLING MACHINE AND CUTTER-HEAD

Cleveland Exposition, Booth No. A-11

The line of thread milling machines built by the Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia, Pa., has been extended to include a fully automatic machine equipped with a hopper feed, as shown in the illustration. The machine follows the general design of the semi-automatic type described in July, 1926, MACHINERY, but differs in several important features. The hopper feed makes the machine fully automatic, and as a laborer can keep the hopper full of blanks, one operator can care for from four to six machines.

The turret-slide is actuated by direct connection to an air cylinder. The work-holding turret has a bearing above and below and differs in this from

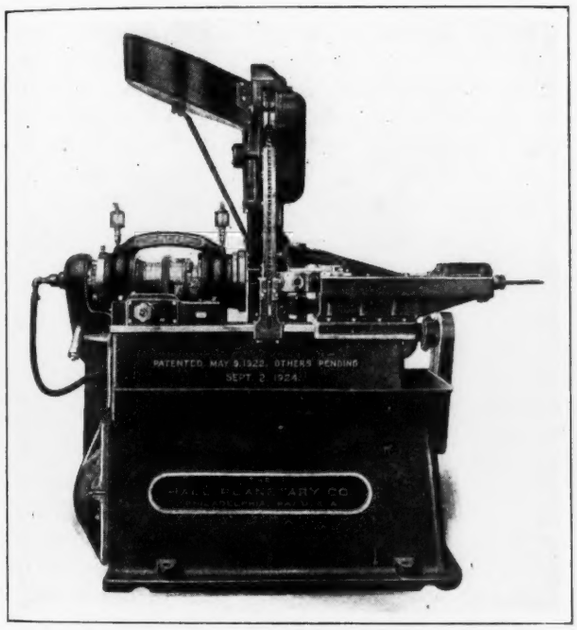


Fig. 1. Hall Automatic Thread Milling Machine

the former model. In the illustration, the machine is shown set up for automobile hub nuts, but with slight changes it may be adapted for many different types of quantity threading and for finishing jobs such as piston-rings, valve fittings, nuts, pipe fittings, electrical fittings, and numerous automobile parts.

A thread milling cutter-head has also recently been developed by the Hall Planetary Co. This head is constructed with a number of leadless cutter "buttons" arranged radially in a circle, as shown in Fig. 2. The cutters have cylindrical shanks and are located endwise by bottoming in the cutter-head. Each cutter is clamped rigidly in position by a headless set-screw having two threads of different pitch. This differential screw principle is employed to pull down the binding block which then presses inward on the cutter shank, due to the tapered hole in the cutter-head. The cutters are made of high-speed steel, and ground from the solid. They are accurately set with the cutting points located radially, by means of a master setting spider which takes its central location from a plug fitting the central hole of the cutter-head.

This type of cutter button has an exceptionally

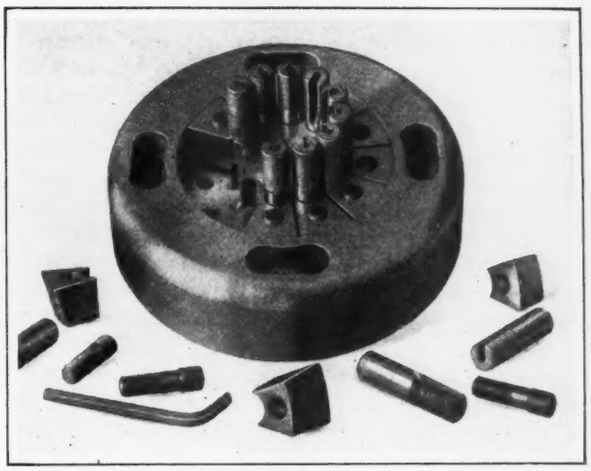


Fig. 2. Thread Milling Cutter-head Made by the Hall Planetary Co.

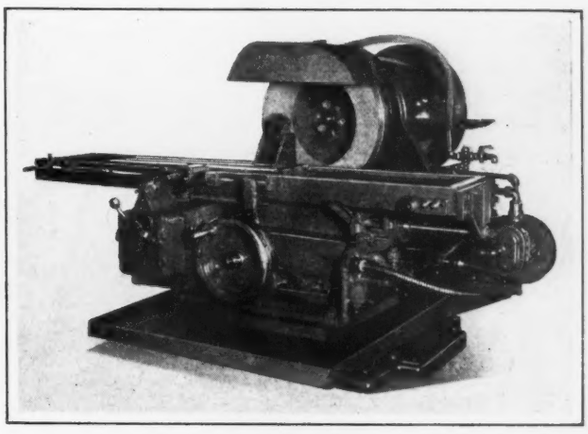
long life, because it follows the general design of a screw machine forming tool. For instance, a cutter button 1 inch in outside diameter has a grinding-back length of approximately 2 1/4 inches. As only 0.010 to 0.020 inch is removed at each grinding, the number of grinds may be anywhere from 100 to 200, according to the metal being threaded. The head is adaptable to both internal and external threading. The cutting edge of each button points radially outward for internal threading and inward for external threading.

The body of the head is located on the cutter-spindle of the planetary thread milling machine by a recess which fits over the spindle end. It is driven by four screws, which hold the cutter-head to the spindle head, the clamping arrangement being such as to permit quick change of cutter-heads.

BADGER HYDRAULIC FACE GRINDER

Cleveland Exposition, Booth No. 127

A face grinding machine with a new hydraulically operated table, built by the Badger Tool Co., Beloit, Wis., is shown in the accompanying illustration. The table consists of a compound slide which is fitted directly to the knee of the base casting, and a reciprocating table top fitted to the top of the compound slide. A long brass cylinder with a piston is rigidly fastened within the compound slide, the outer end of the piston-rod being connected to a block attached to the rear end of the



Badger Face Grinding Machine with Hydraulically Operated Table

table top. The control box containing the necessary valves is mounted at the front of the compound slide. Adjacent to it is the automatic ratchet in-feed, having a large graduated handwheel. Adjustable stop-dogs may be set for any stroke from 1 to 32 inches.

The direction lever—the upper one on the control box—has three positions, forward, reverse, and neutral. To test its instantaneous action, it has been shifted from forward to reverse eighty times a minute, changing the table direction an equal number of times without vibration. This hand-lever is directly connected to the automatic control pawl operated by the stop-dogs.

The lower lever on the control box is for speed regulation. Instant speed adjustment can be made in any position of the table, even while grinding is in progress. If a long casting has two pads far apart to be ground, the table may be slowed down while grinding the first pad, speeded up until it reaches the second pad, and then again slowed down to the grinding speed. Correct speeds for all conditions are thus obtainable, thereby increasing production.

There is no vertical adjustment of the table, as a more rugged construction can be obtained without it. Work-holding fixtures are built to the proper height, and auxiliary table tops of different heights can be furnished. The left end of the machine is fitted with the Badger regular hand-operated lever-feed table. A built-in 15-horsepower motor furnishes the drive, and a 1-horsepower motor operates the oil-pump. The entire unit is fitted for wet grinding, and weighs, complete, 5300 pounds.

The Badger Tool Co. has also introduced improvements in the No. 221 grinder, including the Bowen "one-shot" lubricating system and a new work-feeding mechanism.

ANDERSON BROS. SPOTTER

Cleveland Exposition, Booth No. A-14

Equipment known as a "spotter" has been brought out by the Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill., for spotting, frosting, or flaking flat finished surfaces. This device consists of a set of two spotting tools, together with a number of guides for handling different widths of work. The set is shown in Fig. 1, and one of the spotting tools in use in Fig. 2. A long-handled spotter is provided for heavy spotting, and a short one for lighter work. It is pointed out that spotting is not done only for appearance, but has an even more important use in that it offers

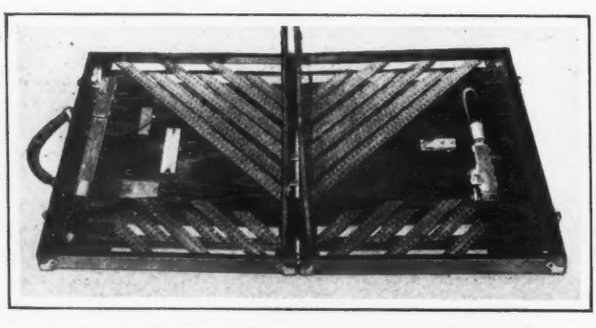


Fig. 1. Set of Anderson Spotters and Guides

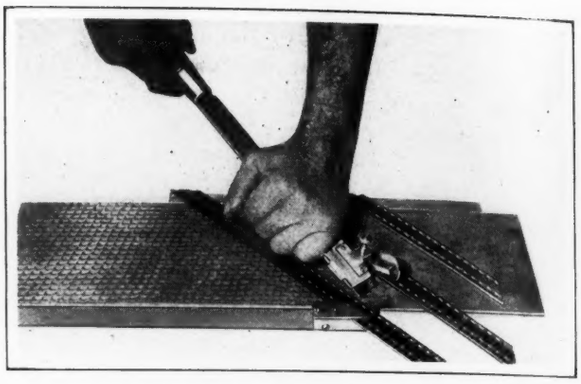


Fig. 2. How the Anderson Spotter is Used

a means for holding oil on the spotted surface.

As the tool is pushed across the guide, which is placed upon the work, a rocking action is given to the blade, causing it to give the half-moon effect on the work. By adjusting a small thumb-screw, different shaped spots may be obtained. With this tool it is possible to do the work of spotting many times faster than with ordinary hand tools, and the work can be done by inexperienced men. Uniformity in the spotting work is also obtained.

LANDIS AUTOMATIC FORMING AND THREADING MACHINE

Cleveland Exposition, Booth No. 416

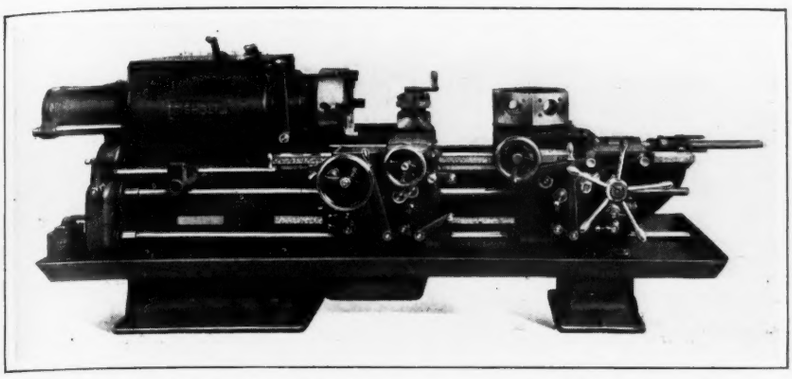
A new automatic forming and threading machine for pointing and threading bolts has been designed and built by the Landis Machine Co., Inc., Waynesboro, Pa. This machine will be shown for the first time at the exposition of the National Machine Tool Builders' Association at Cleveland during the coming month. The machine is entirely automatic and is of the semi-vertical type. It has a range of from 5/16 to 3/4 inch in the diameter of the thread, and from 1 inch to 6 inches in the length of the thread.

GISHOLT TURRET LATHE

Cleveland Exposition, Booth No. 403

A turret lathe known as the model 2-L, designed to accommodate medium-sized work, such as bar stock up to 3 1/2 inches or chucking work up to 16 inches in diameter, has been placed on the market by the Gisholt Machine Co., Madison, Wis. Power is transmitted from a single-pulley drive through a multiple-disk friction clutch running in oil. There are twelve speed changes and reverse, accomplished by means of sliding gears operating on splined shafts. The spindle is mounted in cylindrical babbitt bearings, carried in tapered cast-iron shells for adjustment. The spindle thrust is taken on a large ball bearing against the housing. All other power-transmitting shafts, including those in the apron, are mounted in ball bearings.

The machine is of the universal type having a square turret on the side carriage and a cross-feeding hexagon turret on the rear carriage. A fixed center turret is optional equipment. There is a total of sixteen feeds, and a rapid traverse is provided for the longitudinal movement of the side carriage, the turret carriage, and for the in and out movement of the square turret on the cross-



Gisholt Turret Lathe for Medium-sized Work

slide. A lead-screw thread-cutting device may be furnished, and a taper attachment is located in the side carriage or may be attached to the cross-feeding turret carriage.

The flat ways of the machine are covered with hardened steel plates and lubricated by force feed through the bottom of the slides. The headstock and spindle bearings are splash lubricated, and the traverse and feed mechanisms are lubricated by fresh oil under pressure. The machine is driven by a 10-horsepower motor connected by means of either a V-belt, a flat leather belt, or a silent chain. The weight of the bare machine is 7200 pounds.

BRADFORD LATHE—DRILLING AND TAPPING HEADS

Cleveland Exposition, Booth No. 622

A lathe provided with many new features has been brought out by the Bradford Machine Tool Co., 657-67 Evans St., Cincinnati, Ohio. The features especially emphasized are the arrangements for relieving, coarse screw cutting, taper-turning, drawing in the collet, and quick-change feeding and threading. An oil-pump and chip pan are also provided.

The power transmission to the spindle is another feature worthy of note, the drive being from underneath. About two-thirds of the entire transmission is contained in the front speedbox leg. The gearing has been designed with a view to eliminating transmission shocks to the lathe spindle.

The coarse screw-cutting arrangement will cut threads up to 10 inches lead. The draw-in attachment is provided with collets having a capacity of from 1/8 to 7/8 inch. The quick-change feeding and threading arrangement will cut all U. S. standard threads from 2 to 56. The thread index-plate gives directly both feeds and threads, and no additional change-gears are required. The coarse screw-cutting ratio (15 to 1) can be employed instantly. The lubricating system is of the "one-shot" type, which quickly delivers clean lubricating oil in predetermined amounts to the various parts to be oiled.

The same company has also brought out drill heads of a self-contained type, with the motor and feed mechanism built into one unit. These drill heads have a definite spindle travel of 3 inches, with a rapid approach to the work, required cutting feed, and rapid return after the operation is completed. This cycle of operations is imparted to the spindle by a positive feed-cam mechanism which operates each time the starting lever is depressed and then remains idle until again engaged by the operator.

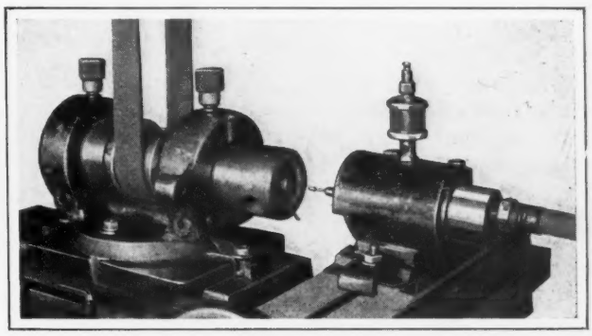
The spindle speed can be varied through a range of from 75 to 2000 revolutions per minute, and the rate of feed per revolution can be varied over a wide range by means of pick-off gears. These heads are furnished in 1-, 2- and 3-horsepower sizes with Nos. 2, 3 and 4 Morse taper, and may be built into complete machines of one or more units placed in any position from the horizontal to the vertical. They can also be furnished with multiple-spindle heads so that a number of holes can be drilled at once.

A tapping mechanism may also be built into the heads, making complete units, a positive rise cam being used to impart the desired lead to the spindle to correspond to the tap lead. The return of the spindle is also controlled by the cam, and does not depend upon the tap. The range of speeds on the tapping spindle is the same as for the drilling spindle, and threads of from 8 to 32 per inch can be obtained with standard pick-off gears. This equipment is made in two sizes—one from 1/4 to 5/8 inch capacity, and one from 5/8 to 1 inch capacity.

EX-CELL-O SPINDLE GRINDING 1/16-INCH HOLES

Cleveland Exposition, Booth No. 609-A
Detroit Exposition, Booth No. 211

The Ex-Cell-O Tool & Mfg. Co., 1469 E. Grand Blvd., Detroit, Mich., has developed a high-speed grinding spindle for the purpose of eliminating the costly process of lapping, which heretofore has been necessary when making tools or parts containing small accurate holes. One of the achievements in this direction is the grinding of holes as small as 1/16 inch in diameter, an operation that is performed daily in the making of Ex-Cell-O drill jig bushings. The air turbine grinding spindle used for this purpose rotates at 65,000 revolutions per minute. The spindle with which this is accomplished is the same as that regularly made by the company, and for the accomplishment of grinding holes 1/16 inch in diameter, the Chicago Wheel & Mfg. Co., Chicago, Ill., should be properly credited. This latter company has produced the wheels that permit this grinding to be done on a production basis.



Grinding Holes 1/16 Inch in Diameter in Ex-Cell-O Jig Bushings

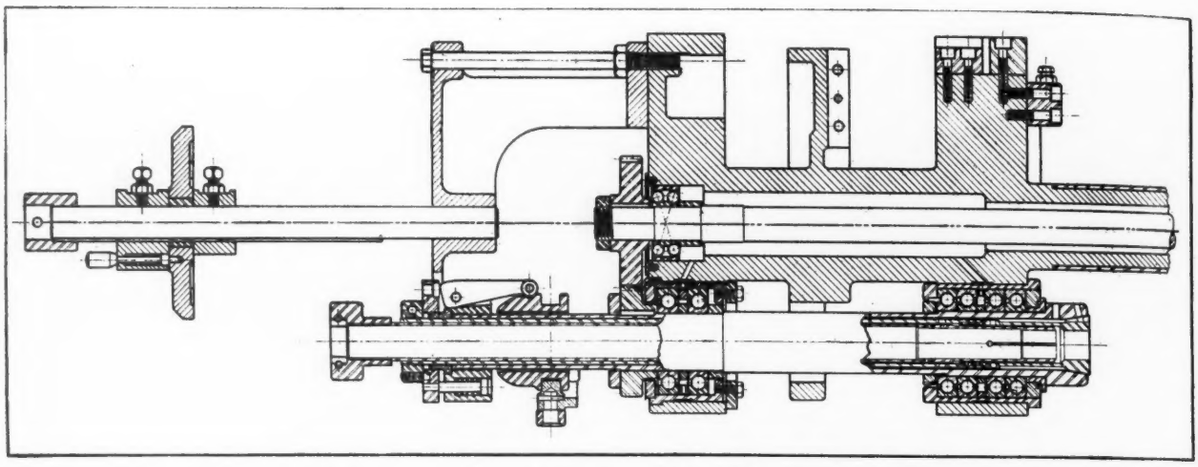


Fig. 1. Spindle Carrier Assembly of New Gridley Multiple-spindle Automatic

GRIDLEY MULTIPLE-SPINDLE AUTOMATIC

Cleveland Exposition, Booth No. 925
New Haven Exposition, Booth No. 21

A new 1 3/8-inch Gridley four-spindle automatic has been developed by the National Acme Co., Cleveland, Ohio, at its Windsor, Vt., plant. This machine has the basic Gridley combination spindle carrier and turret design, but otherwise departs considerably from the construction of previous machines. In the first place, it has full ball-bearing spindles, as illustrated in Fig. 1. Four bearings carry combined radial and thrust loads at the front of each spindle, while two bearings, arranged to float, are used at the rear of each spindle. In addition, every high-speed shaft in the entire machine is ball-bearing equipped.

Important changes have been made in the construction of the spindle carrier to allow the use of high speeds and high tool pressures. The distance between the disks has been increased 50 per cent, and a third disk has been added between the supporting disks to take care of a new form of revolving mechanism. The bearing surface which carries the turret is made of hardened steel. Changes have been made in the stock-feed mechanism which entirely alter the appearance of the machine at the rear. Quicker and more positive feeding of stock is assured by transmitting the cam action more directly to the pusher tubes, chuck-operating spools, etc.

The cross-slides, both front and rear, are 50 per cent wider and 50 per cent longer than on previous machines. They are held down by heavy outside gibs to shelves cast integral with the headstock, the construction being such as to insure rigidity. Power is applied to the cross-slides through a direct cam action and through the medium of a steel draw-bar of large diameter. This bar is supported in outboard bearings in the machine frame. The cross-slides permit the use of heavy forming tools in all positions at maximum feeds, and considerably increase the speed and dependability of cutting-off operations.

The so-called "feed bracket" permits of threading in two positions (with the two upper spindles, Nos. 2 and 3) without resorting to special attachments. This feed bracket is an assembly of various mechanisms having to do with changing the spindle speed, changing the rate of feed, driving and controlling the threading equipment, "cranking the machine over" by hand, etc. The feed bracket is entirely enclosed and has a system of splashers which cause the working parts to run in a mist of oil at all times. This oiling system, coupled with the ball-bearing mounted shafts, has permitted the machine to be given a maximum speed of 1200 revolutions per minute, which is almost double the speed of previous machines.

Both the spindle speed change-gears and the feed change-gears can be quickly changed, it being only necessary to raise covers and remove slip washers in order to do this. A disk clutch is used in the feed mechanism, and it is so arranged that by simply pulling a spring locking pin and turning a collar, adjustments can be made. The mechanism that actuates this clutch also operates a safety device that prevents the use of the hand-cranking mechanism when the power feed is connected.

To permit every position of the ma-

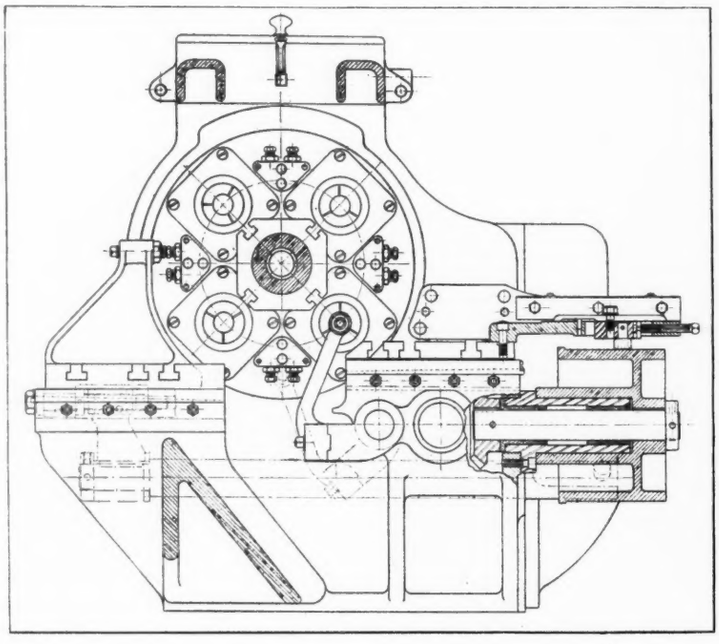


Fig. 2. Sectional View of Gridley Multiple-spindle Automatic, Showing Cross-slides

chine to be a working position, a stock stop located at the fourth position has been so designed that after it has functioned it is instantly moved out of the way of the tools. As may be seen in Fig. 2, this stock stop is pivoted upon a heavy shaft running parallel to the spindles. By cam action the stop is swung down between the cross-slides, as indicated by the dot-and-dash lines, while the machine takes cuts.

The pan of the machine has been greatly changed both in external appearance and internal arrangement. It has high sides which serve as guards as well as giving increased chip capacity. At the bottom of the chip reservoir there is a set of perforated bottom plates through which the oil drains into a large reservoir below. An arrangement of large ports with sloping lips permits of quickly cleaning out the entire accumulation of chips through either end or either side of the machine. Provision has been made in the pan design for the installation of a continuous chip-removing mechanism based upon a conveyor- or belt principle.

One of the problems introduced by the application of unusually high speeds to multiple-spindle automatics is that of overheated cutting oil. The new pan solves this problem by immediately separating the cutting oil from the hot chips and then causing the oil to circulate about the large reservoir. In the reservoir the oil comes in contact with a large area of heat-radiating surfaces by which it is cooled before being again pumped back to the work. This arrangement has been found to have a distinct effect in keeping the entire machine cool under high-speed operation.

The major improvements outlined in this article, as well as many minor ones, have resulted in a machine of greatly increased productive capacity.

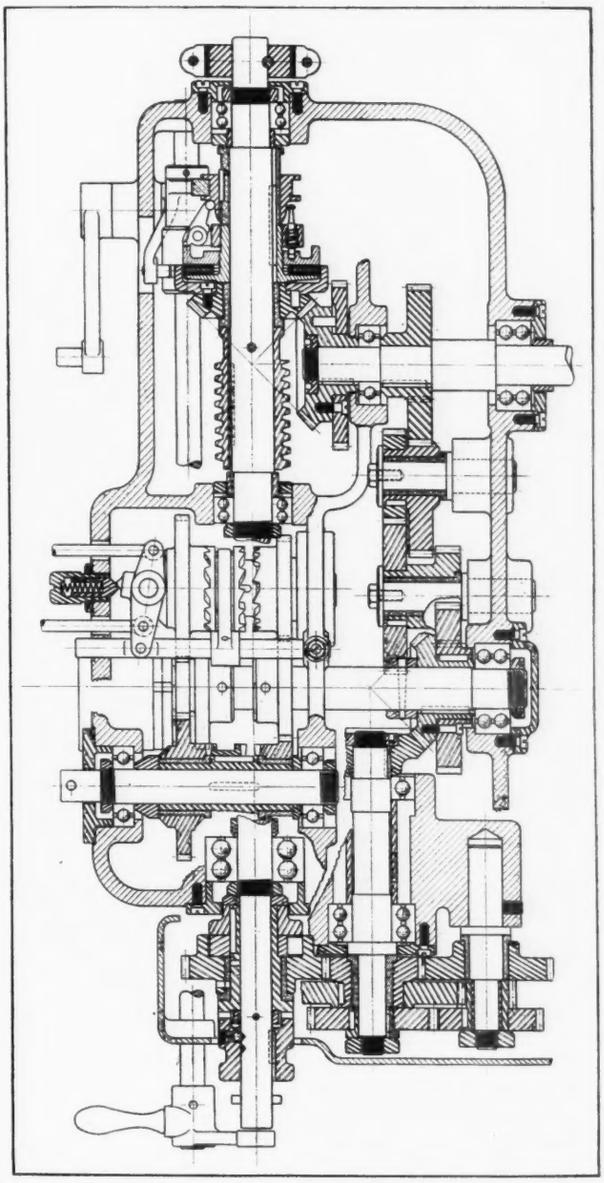


Fig. 3. Gear-case Assembly

SOCIETE GENEVOISE JIG BORING MACHINE

Detroit Exposition, Booth No. 237

A No. 7 locating and jig boring machine embodying an important new principle has recently been developed by the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, and placed on the American market by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. This machine has three spindles for locating and boring holes in the length, width, and height dimensions, instead of in the length and width dimensions only, to which the previous types of jig borers have been limited.

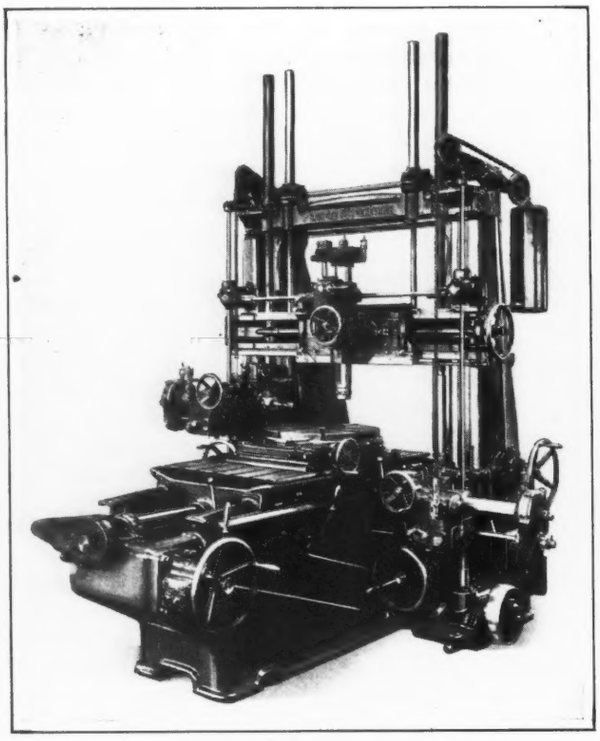
Another feature of the machine is that three holes can be bored simultaneously in the same plane, the direction of one being at right angles to that of the other two. The second and third holes may be from opposite directions in the same straight line. Thus, the machine is especially adapted to the boring of box jigs or fixtures when alignment of holes on opposite sides is necessary, and at the same time, holes are required on top of the jig. The machine is also designed for boring holes in large flat pieces.

The general construction, as well as the principles of measurement and drive, is the same as that of the Nos. 4, 5, and 6 jig borers. The rectangular table measures 51 by 28 inches, and the cross-rail can be raised and lowered through a range of 25 inches. The slide on the cross-rail which carries the vertical spindle has a cross motion of 28 inches, while the longitudinal table motion is 40 inches.

The uprights are heavier than in previous machines, as each carries a horizontal spindle, the slide of which is counterpoised by weights at the back of the machine. The horizontal spindles may be moved 30 inches by means of micrometer screws. Automatic compensating devices eliminate the small residual errors of these screws and also of the screws that move the table and the vertical spindle slide.

The maximum height of the vertical boring head above the table is 30 inches, while that of the horizontal heads is 24 inches. The horizontal heads may be lowered below the surface of the table to permit using the full space of 35 1/2 inches between the vertical stands for large flat work.

The left-hand horizontal boring head is provided with a bearing which guides a horizontal boring-bar driven by the opposite spindle. The center of



Societe Genevoise Locating and Jig Boring Machine

this bearing is 7 inches above that of the spindle itself. A nine-speed gear-box driven by a single pulley furnishes spindle speeds varying from 40 to 300 revolutions per minute. Bosses at the rear of the bed provide for attaching either a driving motor or two pulleys for transmitting power from overhead.

A circular table, 23 1/2 inches in diameter, having a graduated drum and vernier reading to one second, has been designed for the machine. With this jig borer, holes up to 1 1/4 inches in diameter may be drilled in soft steel or 1 3/4 inches in diameter in cast iron. The maximum diameter that can be bored is 6 inches. Holes up to 12 inches deep can be finished. The machine weighs about 13,000 pounds.

STAGE FOR HARTNESS COMPARATOR

Cleveland Exposition, Booth No. 217
New Haven Exposition, Booth No. 125

A universal stage which accommodates a wide range of diameters and pitches of screws and taps has been brought out by the Jones & Lamson Machine Co., Springfield, Vt., for use with the Hartness comparator. This stage is made up of a frame carrying rolls on which the threads are supported at the pitch line. There is also an adjustable backstop for positioning the screw on top, and a spring plunger which holds the screw down on the rolls and back against the stop. The rolls are free to revolve, one being fixed longitudinally in relation to the lens, while the other is free to accommodate itself to the thread.

With the adjustments provided, the pitch diameter, lead, and form of screws from 1/4 to 1 3/8 inches in diameter and of any number of threads from 6 to 28 per inch within the diameter range can be tested.

GRAND RAPIDS UNIVERSAL CUTTER AND TOOL GRINDER

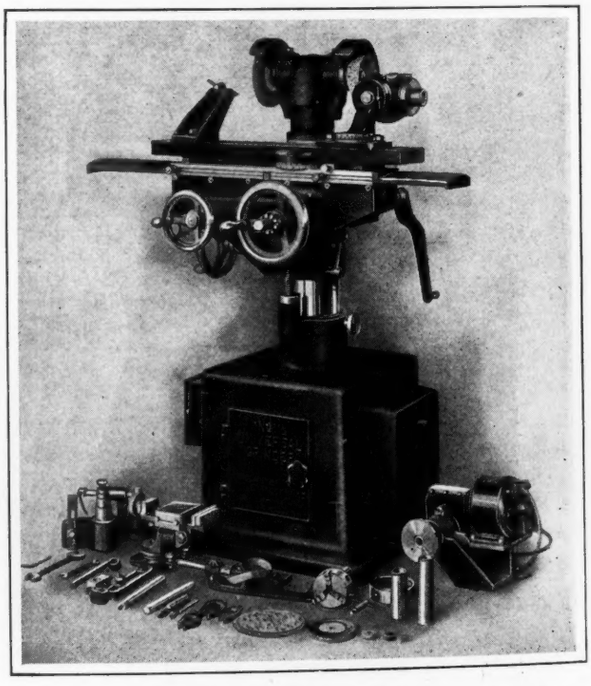
Cleveland Exposition, Booth No. 623

A Grand Rapids No. 1 1/2 universal cutter and tool grinder recently brought out by the Gallmeyer & Livingston Co., 344 Straight Ave., S.W., Grand Rapids, Mich., has been designed to meet the needs of plants requiring a machine of medium capacity for such operations as grinding face mills, form cutters, angle cutters, gear cutters, end-mills, reamers, and spiral and plain milling cutters, in addition to plain internal and cylindrical grinding.

In designing the machine, convenience of operation was considered. The knee, saddle, sub-table, and table swing around the column, while the table, in turn, swivels on the sub-table. Transverse vertical and longitudinal movements can be controlled from a position directly in front of the machine or from the rear. Both handwheel and lever controls are provided for the longitudinal movements.

The vertical and cross-feed movements are obtained by means of Acme-thread feed-screws runing in a bronze nut. Graduated dials reading to thousandths of an inch are provided for both movements. The longitudinal movement is obtained by means of a steel rack which meshes with a steel pinion.

The machine can be either belt-driven or provided with a self-contained motor drive. When furnished with a motor drive, the equipment includes a one-horsepower motor placed in the base of the machine for driving the main spindle, and a 1/4-horsepower motor built into the headstock for revolving the work. The table measures 5 by 26 inches; the longitudinal travel is 16 inches, the transverse movement, 8 inches, and the vertical movement, 6 3/4 inches. The maximum distance from the center line of the spindle to the table is 9 1/2 inches, and the maximum swing, 9 1/2 by 20 inches. Face milling cutters up to 12 inches in diameter can be ground.



Gallmeyer & Livingston Universal Cutter and Tool Grinder

THOMSON WELDING MACHINES

Detroit Exposition, Booth No. 125

A No. 180 spot welder and a No. 375 double-roller seam welder constitute recent developments of the Thomson Electric Welding Co., Lynn, Mass. The spot welder has a rating of 7 1/2 kilowatts 10 kilovolt-amperes for continuous production. An extra high tap is provided on the five-point regulator for use in intermittent welding. With this the load may be increased to 14 kilowatts 17 kilovolt-amperes. The machine is shipped with the low tap connected.

This welder has a capacity for two No. 16 gage pieces of iron or steel for average production, but can accommodate two 1/2-inch pieces at a slow rate of speed as an over-load. Aluminum and brass up to No. 22 gage can be handled with "Elkonite" dies. Mounted on the back bar is a 220-volt line break switch which prevents current from being turned on before the dies touch the work. The transformer is air-cooled, and the dies may be water-cooled or made of solid copper. The welder weighs about 700 pounds.

The seam welder has a rating of 75 kilowatts 100 kilovolt-amperes. This machine is equipped with a regulator having fifteen points of regulation. It has a capacity for welding two pieces of clean iron or steel from No. 22 gage to 1/8 inch, depending upon the length of seam and type of weld.

The horns are made of cast copper and water-cooled. Two lower horns are supplied, one for welding longitudinal seams and one for welding circular seams. The lower horn has a 4-inch vertical adjustment. Eight inches is the minimum diameter of cylinder that can be welded longitudinally on a standard horn. The rollers are made of hard rolled copper and are mounted on a hollow water-cooled shaft or on a solid externally cooled shaft. The upper roller mounted in the head can be turned at right angles when making either type of seam.

Fig. 1. Thomson Spot Welder of New Design

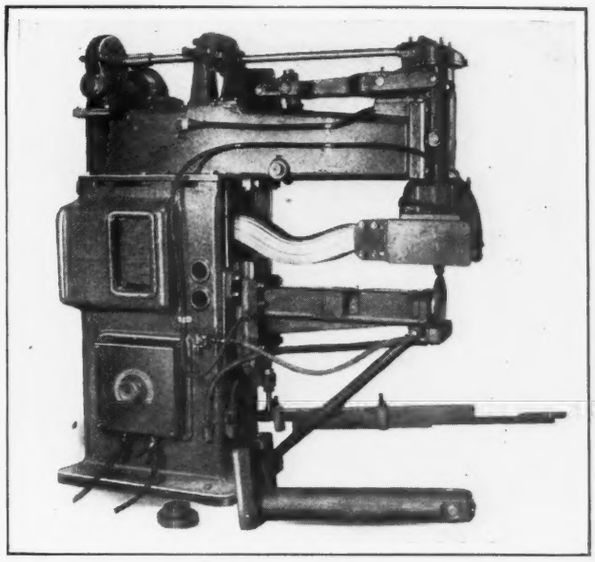


Fig. 2. Machine for Welding Longitudinal and Circular Seams

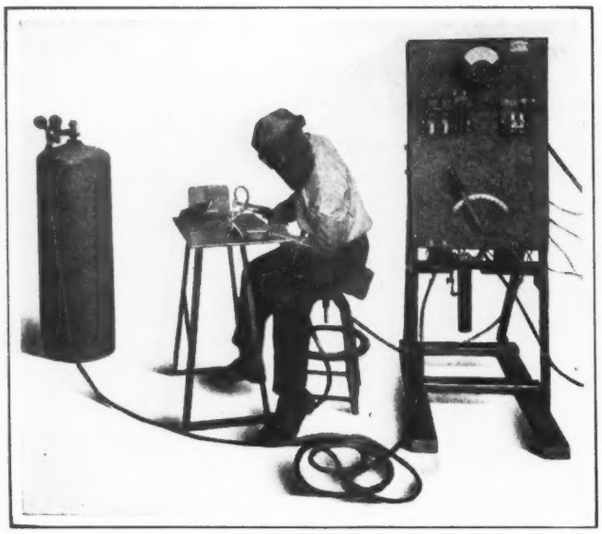
The drive may be either by belt or a 1/2-horsepower motor running at 1200 revolutions per minute. Change-gears are furnished to obtain linear welding speeds of 6, 9, 12, and 15 feet per minute. Through the foot-treadle, a maximum pressure of 1500 pounds can be exerted on the rollers. When the treadle is depressed, the rollers are automatically locked in the welding position. At the completion of the weld, another depression of the treadle automatically releases the head. The switch is automatically closed and opened by these successive depressions of the foot-treadle. This machine weighs approximately 4700 pounds.

GENERAL ELECTRIC ATOMIC HYDROGEN WELDING OUTFIT

Detroit Exposition, Booths Nos. 127 and 148
New Haven Exposition, Booth No. 103

Atomic hydrogen welding—the process by means of which hitherto unweldable metals can be fused without oxidation and by which welding can be performed in some cases on metals as thin as paper—is made practicable by the use of equipment recently placed on the market by the General Electric Co., Schenectady, N. Y. This method utilizes a stream of hydrogen passed through the arc between two electrodes. Since atomic hydrogen is a powerful reducing agent, it reduces any oxides which might otherwise form on the surface of the metal. Alloys containing chromium, aluminum, silicon, or manganese can be welded without fluxes and without surface oxidation.

The new welding outfit consists of a single-phase transformer for converting the voltage of a 60-cycle source of power to one suitable for the welding equipment; a variable reactor to provide the proper welding current and voltage for different classes of work; and a welding torch by which the actual welding is performed. The torch consists of a holder supporting two tungsten wire electrodes, the electric conductors connecting these electrodes to the reactor, and the tubing for the hydrogen gas.



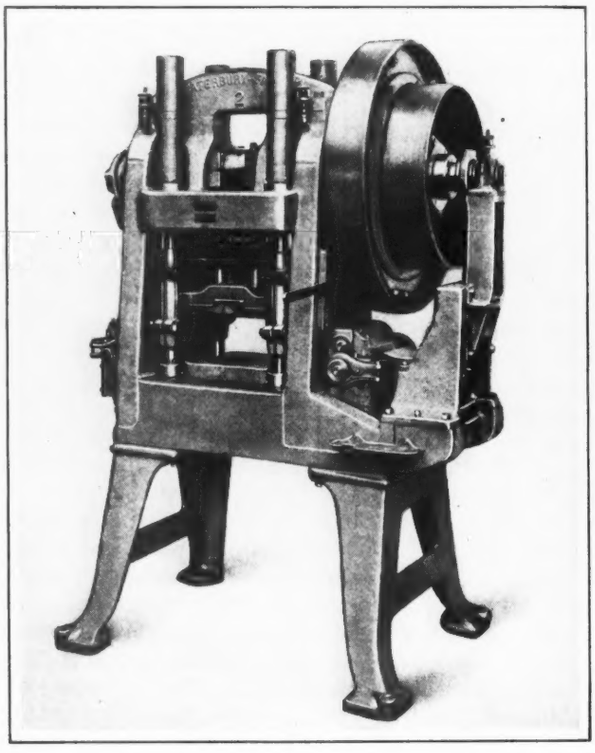
General Electric Equipment for Hydrogen Welding

Each electrode is supported inside a nozzle through which the hydrogen is forced out around the electrode. The equipment so far marketed is for operation from 60-cycle single-phase circuits only, and is recommended for use on ordinary metals of less than 1/4 inch in thickness, or on hitherto unweldable metals of greater thickness.

WATERBURY-FARREL FOUR-POST BLANKING PRESSES

Detroit Exposition, Booth Nos. 217 and 219

Important features claimed for the four-post high-speed blanking presses brought out by the Waterbury Farrel Foundry & Machine Co., of Waterbury, Conn. (see illustration), include bearings above and below the tools to insure accurate alignment; shock-absorbing flywheel which makes possible unusual speeds; friction mechanism which will stop the press from high speed and only exerts friction when stopping; double gate connections which are simultaneously adjusted; lifter springs on each guide post which take up all backlash in the connection bearings; hand and automatic roll releases; and rigid frame designed to facilitate the application of special attachments or the changing from a belt to an individual geared motor drive.



Waterbury-Farrel Four-post Blanking Press of Intermediate Size

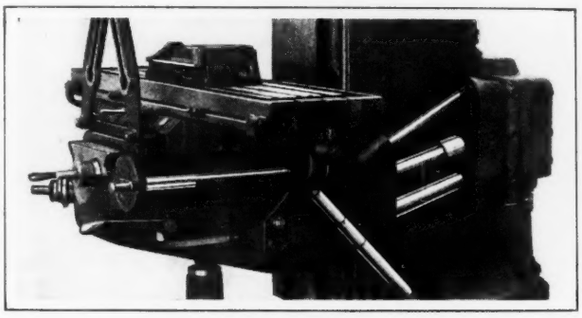
The presses are regularly furnished with a double friction-roll feed, scrap shear, flat-bottom punch-holder in the gate, heavy bolster, double eccentric connection with simultaneous adjustments, and stock guides. Any design of knock-out can be applied.

Three standard sizes are built, having capacities of 20, 40, or 60 tons. They weigh 2300, 5000, and 7600 pounds, respectively.

KEARNEY & TRECKER DIAL FEED CONTROL

Cleveland Exposition, Booth No. 205

A dial feed control has recently been developed by the Kearney & Trecker Corporation, Milwaukee, Wis., for the milling machines made by this concern. By means of a single crank lever and direct-reading dial located at the right-hand front side of the knee, as shown in the accompanying illustration, it is possible to instantly secure eighteen changes of feed. Feeds can be changed when the machine is running or when it is idle. A sliding-gear selective-type feed-box is located at the rear of the machine column, which is automatically lubricated by the same pump that lubricates the inside of the column. The principal shafts in the feed-box are mounted in ball bearings.



Kearney & Trecker Dial Feed Control

In operating the feed control, the crank is turned by one hand in either direction until the desired feed, as indicated by the figures on the dial, is opposite the arrow. There are two positions in which the plunger can be engaged, but it is not necessary for the operator to pay any attention to these positions. When any desired feed number on the dial is brought into position above the arrow, the plunger will always be directly opposite one of the two locating holes, and when released by the operator, will drop into place.

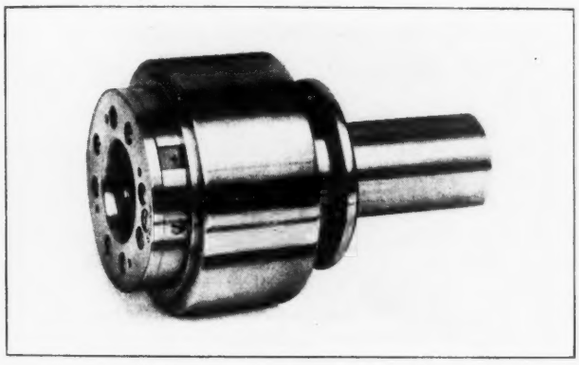
The eighteen feeds available range from 5/16 inch to 25 inches per minute. As the rotary dial is direct-reading, the foreman or time study man can tell at a glance what feed the operator is using on any job.

H. & G. DIE-HEAD

Cleveland Exposition, Booth No. 604

An H. & G. die-head known as style EE and intended for use on rotating die-spindles, is being introduced to the trade by the Eastern Machine Screw Corporation, New Haven, Conn. This die-head is opened and closed by one yoke which engages the spool or groove at the rear of the head. The outside diameter of the head is smaller than in previous styles, and an improved locking and tripping mechanism is employed. Accurate adjustment for the length of thread cut is obtainable. As one yoke opens and closes the head, it is a simple matter to install the device on an automatic screw machine.

The new die-head uses the same basic principle of holding the chasers and of supporting them directly over the chamfer, and has the same positive opening action as other H. & G. die-heads. The new head takes the same chasers as the other styles of heads made by this manufacturer, and is available in the following sizes: 7/16-inch size with an outside diameter of 2 3/8 inches; 9/16-inch size with an outside diameter of 2 7/8 inches; 1-inch size with an outside diameter of 3 15/16 inches; and 1 1/4-inch size with an outside diameter of 4 5/8 inches.



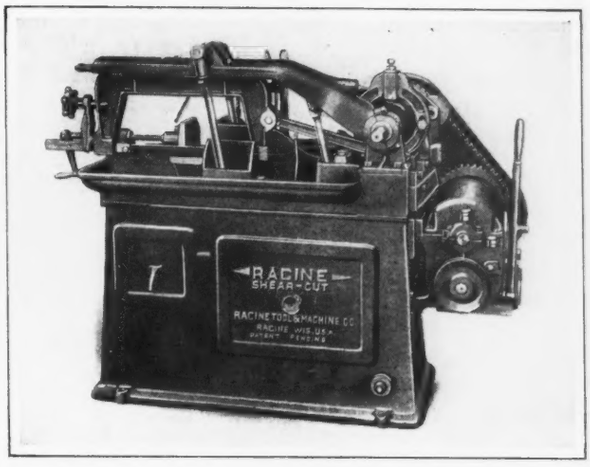
H. & G. Die-head for Rotating Spindles

RACINE SHEAR-CUT PRODUCTION SAW

Cleveland Exposition, Booth No. 112

Production saws made by the Racine Tool & Machine Co., 250–15th St., Racine, Wis., have recently been improved by the addition of several new features. The gear-box of previous machines, in which changes of speed were obtained through tumbler gears, has been replaced by a new sliding gear transmission mounted on the rear of the machine. The drive from the gear-box to the main shaft is by a steel roller chain, as illustrated. The flexibility of this chain drive has a tendency to eliminate vibration and knocks, even when the bearings have become worn after a long period of service.

The motor which drives the transmission through a worm and worm-gear is partly enclosed in the base of the machine at the rear. This method of mounting the motor serves to reduce the floor space occupied by the machine. The direct worm-gear drive is used on both the three-speed and single-speed machines made by the company. A double bearing for the saw guide on the main shaft and also the straight-line pull of the connecting-rod are important features of the machine.



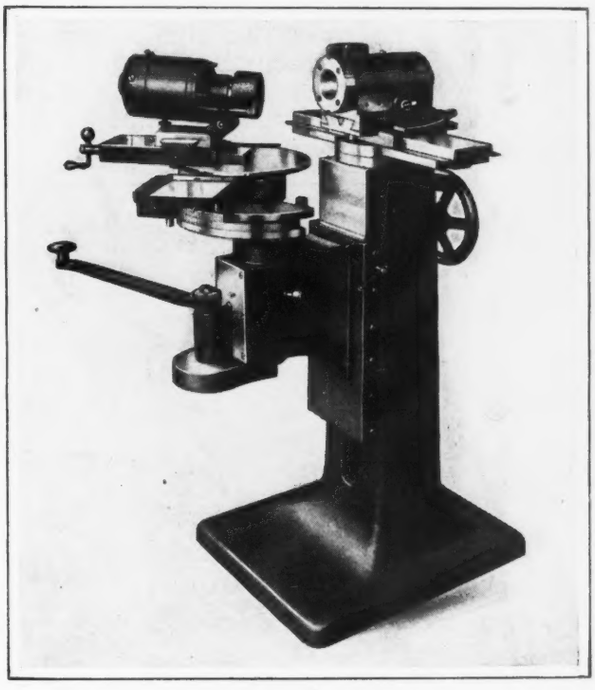
Racine Shear-cut Production Saw

OLIVER FACE-MILL GRINDER

Cleveland Exposition, Booth No. 121

A face-mill grinder placed on the market by the Oliver Instrument Co., 1410 Maumee St., Adrian, Mich., grinds the face and periphery of the cutting blade at one pass of the wheel, and forms a circular corner which joins the two so that the entire cutting edge is smooth and continuous. Only one setting of the cutter is required in grinding. This machine can also be used for grinding other types of milling cutters and form tools, and for performing grinding operations requiring a radial motion of the grinding wheel or a combined straight and radial motion.

The extent of the arc ground is governed by the position of two cam plates beneath the motor slide.



Oliver Machine for Sharpening Milling Cutters and Form Tools, etc.

With the plates furnished, the machine has a capacity for arcs having included angles from 60 to 120 degrees, but with special plates, arcs with included angles up to 180 degrees can be ground. The radius of curvature is determined by the distance to the grinding face of the wheel from the center of rotation. This can be varied from 0 to about 2 inches.

The wheel carriage is actuated by means of a hand-lever, the direction of motion changing from straight to radial, or vice versa, at a predetermined point without any other assistance than that of the lever. When the carriage is moving in a straight line, it is locked against radial travel and when turning about an arc, it is locked against longitudinal motion. It is possible to grind a face mill with a different clearance on the periphery than that ground on the face.

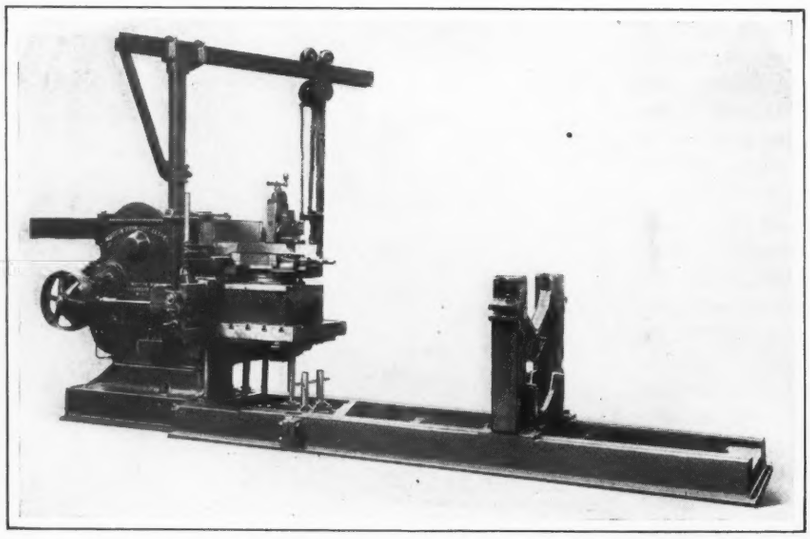
The spindle has the standard nose adopted by milling machine manufacturers. A transverse and longitudinal adjustment provide for the accommodation of cutters up to 18 inches in diameter and 6 inches in thickness. The machine weighs about 1000 pounds.

MORTON ROLL-WABBLE SHAPER

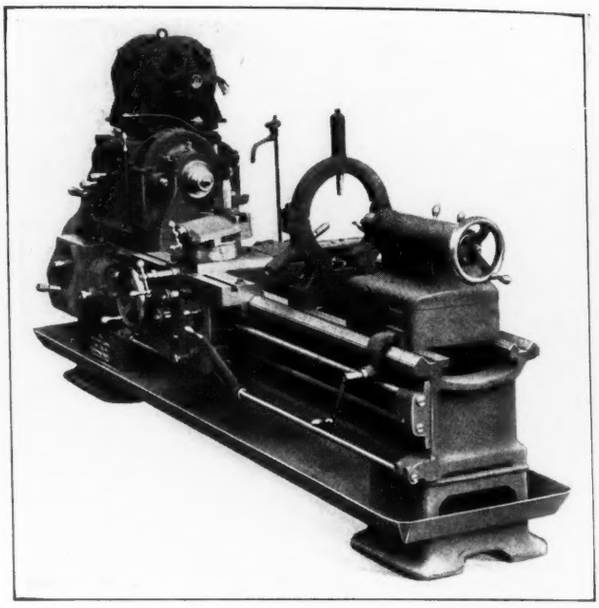
Cleveland Exposition, Booth No. A-7

A combined heavy-duty draw-cut and roll-wabble shaper that may be either belt or motor driven has just been built by the Morton Mfg. Co., Muskegon Heights, Mich. This machine is intended for shops manufacturing rolls, or for shops using rolling mill equipment where there are only a few rolls to be machined and where there is other heavy-duty shaping or planing work. The machine will finish the ends of any roll up to 56 inches in roll diameter and 28 inches in neck diameter.

This machine has a cutting stroke of 48 inches and a vertical feed of 18 inches. It can be furnished with a horizontal feed on the cross-rail of 36, 48, or 60 inches. The shaper can be quickly converted from a draw-cut to a push-cut machine for the cutting of pods in rolls. It is equipped with an auxiliary top plate, heavy steel vise for general work, large T-slotted work-table, crane, hoist, and a special V-block for holding the rolls.



Morton Combined Heavy-duty Draw-cut and Roll-wabble Shaper



Cincinnati Lathe & Tool Co.'s Geared-head Lathe

CINCINNATI GEARED-HEAD LATHES

Cleveland Exposition, Booth No. 111

Improvements have been introduced in the geared-head lathes built by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio, as shown in the accompanying illustration. These lathes are built in sizes to swing work from 16 1/2 inches to 32 inches in diameter, and are provided with twelve spindle speeds, obtained by simply shifting a lever. The gears contained in the lower half of the housing, which is of oil-tight box construction, are forged from manganese chrome-alloy steel, heat-treated in oil, and ground. At the bottom of the housing is a sediment basin, from the lowest point of which the oil may be entirely drained when it is desired to replace the oil in the headstock. A sight-feed oil gage is located at the rear, which shows the level at which the oil is maintained. All bearings, except the main spindle bearing, are lubricated by the splash system, even when operating at the slowest speeds and without oil leakage. The main spindle bearings are oiled through sight-feed oilers.

The clutch or driving mechanism is an integral part of the housing, reducing overhang and relieving the drive shaft from bending or torsional strains. Adjustment for wear, if necessary, is quickly made by loosening the locking screw, moving the ring nut to the right, and then simply tightening the locking screw again. The clutch is of the compression disk type, transmitting the full horsepower rating of the motor. It may be operated from the apron lever or from a lever located on top of the headstock. The same lever is used to move the gearing slightly when changing spindle speeds, thus avoiding gear clash. Geared-head lathes with a single-pulley belt drive may be converted to direct motor drive at any time after installation.

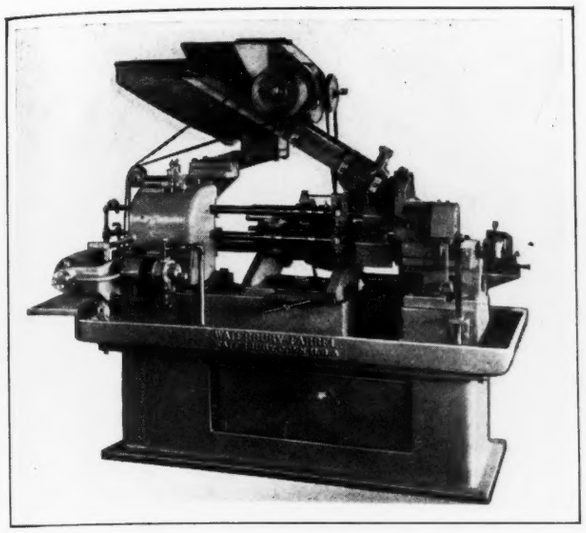


Fig. 1. Waterbury-Farrel Automatic Combination Bolt Pointer and Threader

WATERBURY-FARREL BOLT MACHINERY

Detroit Exposition, Booth Nos. 217 and 219

A new automatic machine for pointing and cutting threads on bolts, of the design shown in Fig. 1, has been added to the line of bolt-making machinery built by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

The blanks pass automatically from a rotor hopper to the pointing station. After pointing, the blank is transferred to the threading station. The threading of one blank and the pointing of the next one occur simultaneously.

The threaded blanks pass down to a work-box at the rear, and the work and chips are automatically separated. The tool-spindles are hollow and the lubricant is pumped through them from the back, thus keeping the tools flushed out and free from clogging chips. Only one adjustment is required for changing from one length of blank to another. The machine can be readily arranged for either a belt drive or for an individual motor drive.

The machine illustrated has a capacity for 3/8-inch diameter bolts, 3/4 to 6 inches long under the head, but machines of other sizes can be supplied. The production (which depends on the cutting speed and the length and pitch of thread) is from 360 to 2000 bolts per hour.

Another recent development of the same company consists of the automatic bolt head trimming machine shown in Fig. 2. The important features of this machine include complete separation of chips and trimmed blanks; high speed of operation; positive ejection of trimmed blanks through the die; newly designed rotor hopper feed; improved transfer mechanism for carrying the blanks from the feed chute to the tools; accessibility for setting up and adjusting; and provision for either belt or direct-geared enclosed motor drive. The machine will trim any length without special tooling.

The punch is fixed in the frame and the die in a block on the reciprocating gate—a construction that makes possible the use of a positive knock-out for any length of blank. The work is trimmed by pushing the die over the projecting head of the blank.

The capacity of this machine is for 3/8-inch diameter bolts from 3/8 to 4 1/2 inches long, and the production, 115 bolts per minute. The net weight without the motor is 7900 pounds.

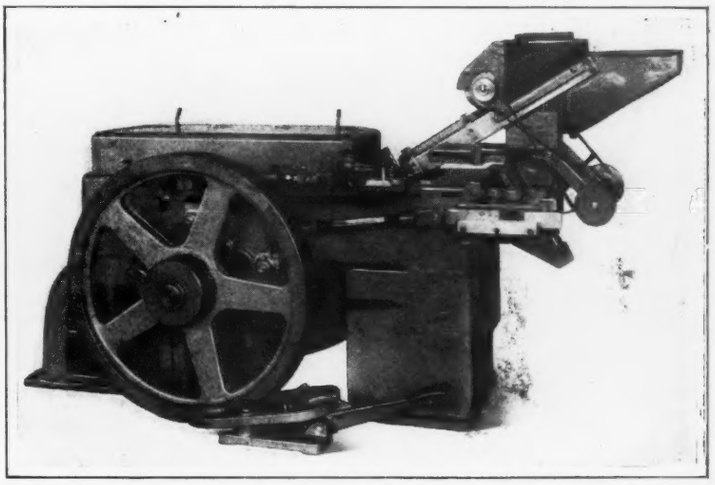


Fig. 2. Waterbury-Farrel Automatic Bolt Head Trimmer

BLANCHARD GRINDING WHEELS

Cleveland Exposition, Booth No. 628

The Blanchard Machine Co., 64 State St., Cambridge, Mass., is announcing the manufacture of cylinder wheels for Blanchard surface grinding machines. Every individual wheel is graded by accurate mechanical means and marked with its actual grade. This grade, together with the grit and type of wheel, is marked on a metal tag soldered to the upper wire band, as well as on the cloth tag inside the wheel. The grades are designated by numbers—40, 50, 60, etc.—and the company will furnish a table which shows the grades generally suitable for various materials.

LANDIS PLAIN HYDRAULIC GRINDER

Cleveland Exposition, Booth No. 226

In Figs. 1 and 2 (see page 26) are shown a 10-inch by 52-inch plain grinding machine equipped with hydraulic power in-feed to the wheel-head, built by the Landis Tool Co., Waynesboro, Pa. This machine is one of a series built in swings of 14, 16, 20, 24, and 28 inches, and in any desired length. Equipment is furnished to cover a large range of work, such as roll grinding; wide-wheel or plunge-cut grinding with a continuous feed to the wheel-head and a reciprocating spindle; crankshaft grinding; railroad work which requires a gap in the table; and all kinds of plain or form grinding.

Features of earlier machines that have proved successful have been retained, such as the hydraulic power traverse which gives a wide range of speeds to the table; large-diameter grinding wheel which is economical in wheel cost; massive wheel-head with large spindle and bearings and positive lubrication; and arrangement for either a self-contained motor drive or lineshaft drive.

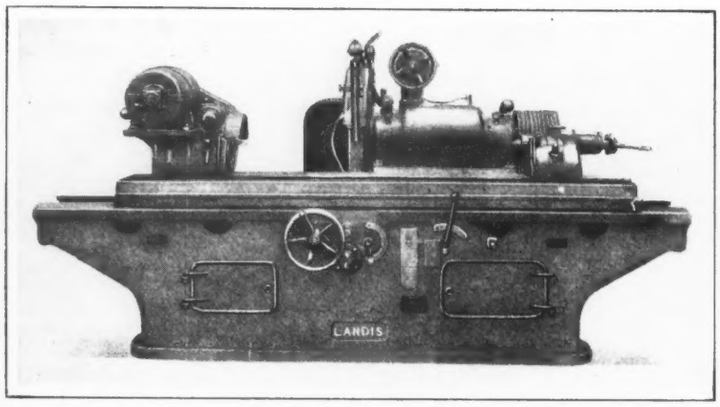


Fig. 1. Landis 10- by 52-inch Plain Hydraulic Grinding Machine

The carriage may be traversed at a speed of from 12 to 300 inches per minute. The variable flow oil-pump used furnishes only the amount of oil required for any desired speed. This obviates any extra duty on the pump.

The headstock is driven by a self-contained motor mounted on top of the headstock. The drive is through a "Tex-rope" to a worm meshing with a worm-gear mounted on the faceplate. The motor is of the variable-speed type and is balanced to eliminate vibration. The work speed is controlled by a rheostat at the front of the machine.

The grinding wheel-head is carried on vee and flat bearings, the wheel feed being actuated through a screw and nut on the under side of the base. The wheel-spindle is mounted in adjustable bronze cap bearings and is automatically lubricated from a pump driven by the spindle itself. Positive lubrication is also provided for the thrust bearings.

The spindle is driven from the front end by a "Tex-rope" drive, which permits a change of pulleys to compensate for wheel wear. An idler pulley maintains uniform tension on the drive, as shown in Fig. 2, where the guard over the drive is removed. This illustration also shows the bracket at the rear of the machine, which is furnished only when the machine is arranged for a lineshaft drive.

The motor for the work drive as well as for the wheel drive varies in size according to the size of the machine and the character of the work. The work drive motor has speeds ranging from 500 to 2000 revolutions per minute, while the wheel drive motor is of the constant-speed type and runs at 1150 revolutions per minute.

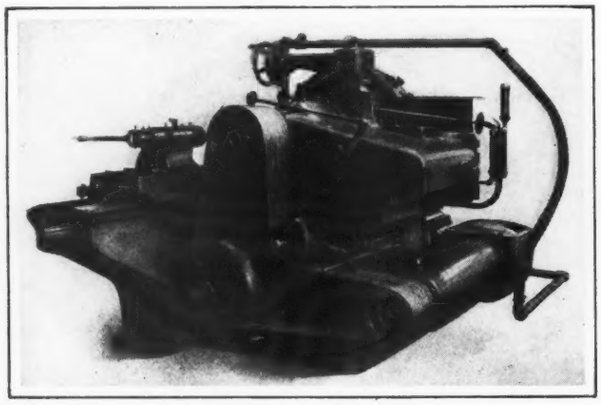


Fig. 2. Wheel-spindle Drive of Landis Hydraulic Grinder

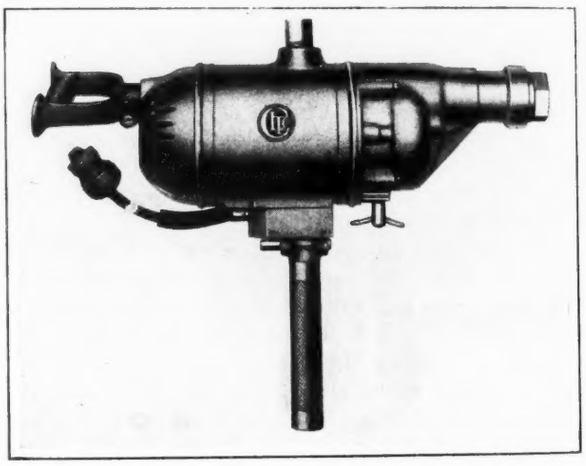
CINCINNATI TWO-SPEED PORTABLE ELECTRIC DRILL

Cleveland Exposition, Booth No. 721

A portable electric drill known as the type UR has recently been added to the line made by the Cincinnati Electrical Tool Co., 2674 Madison Road, Cincinnati, Ohio. This new drill has the same capacity as the 7/8-inch type UN, but is provided with gearing which gives a higher spindle speed when it is desired to use small-sized drills. The normal speed is 380 revolutions per minute and the higher speed gearing can be instantly engaged by a shift lever without stopping the motor.

The new drill is fitted with a No. 2 Morse taper socket in a removable sleeve. As the tang of the drill bit protrudes slightly beyond the end of the sleeve, the use of a drift in removing the drill is unnecessary. Radial ball bearings are employed and grease reservoirs provide for adequate lubrication.

Square-type brush holders allow adjustment of the brush spring tension. The patented Cincinnati fully-enclosed switch with cable clamp is standard equipment. The drill can be furnished wound for 32-, 110-, or 220-volt current, while the universal motor allows for operation on both direct and alternating current of the same voltage.



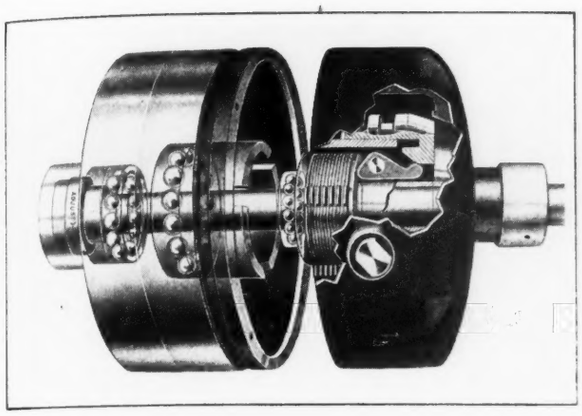
Cincinnati Drill which may be Operated at Two Speeds

AMERICAN MULTIPLE-DISK FRICTION CLUTCH

Cleveland Exposition, Booth No. 614

All geared-head lathes built by the American Tool Works Co., Cincinnati, Ohio, are now equipped with the leak-proof multiple-disk clutch unit here illustrated. This entire clutch unit is mounted on ball bearings, and the thrust of the multiple driving disks is taken on a ball thrust bearing. The driving disks are of hardened steel, and are continuously flooded by oil under pressure. Every other disk is given a permanent warp to a depth of 0.005 inch, which causes the disks to spring apart when released, and permits the oil to thoroughly lubricate and cool them.

Among the advantages of the clutch are ease of adjustment and sensitiveness of control. Adjust-



Multiple-disk Clutch Unit for American Tool Works Co.'s Geared-head Lathes

ment is made through a threaded collar on the outside of the clutch where it is always accessible. The clutch unit is oil-tight, and there is no dripping of oil on the lathe or floor.

The initial driving unit is exactly the same for both belt and motor drives, except that when a geared motor drive is used, the pulley is replaced by a heat-treated alloy-steel herringbone gear. When desired and specifically ordered, this driving unit may be arranged to drive in both the forward and reverse directions, without reversing the direction of the pulley or the herringbone gear. When the reversing mechanism is incorporated, a brake is provided which operates between the forward and reverse speeds, making the reversal practically instantaneous, the brake bringing the rotating members to a stop before the drive in the opposite direction begins.

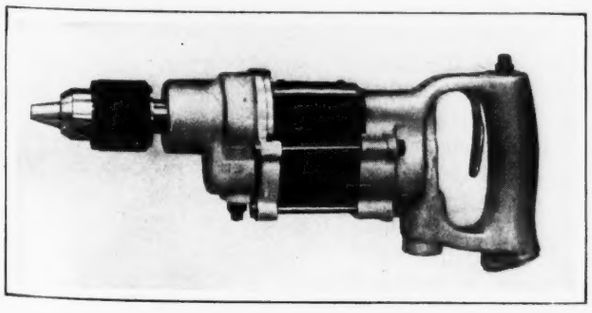
The clutch unit is operated by a drop lever located on the lathe head, and also by a mechanical control lever at the right-hand side of the lathe apron. By operating either of these levers, the driving disks are engaged or released to start or stop the spindle. To assist in stopping the spindle quickly, an external band brake, which operates automatically, is provided on the initial drive shaft.

ROTOR AIR DRILLS

Detroit Exposition, Booth No. 150

Three air drills of 1/4, 3/8, and 1/2 inch capacity have recently been added to the line manufactured by the Rotor Air Tool Co., 5905 Carnegie Ave., Cleveland, Ohio. The motor provided in these drills is a patented Rotor type, consisting of twin eccentric rotors mounted on the spindle, which runs in ball bearings. A special governor controls the free speed of the machine, cutting down the air when running idle and thus substantially reducing the air consumption. The governor opens the air ports as the load on the motor is increased, and automatically maintains the correct cutting speed for the drill point.

The drills are designed to permit close corner work, and their weight has been kept low by the use of aluminum alloys. The 1/2-inch drill weighs 7 1/4 pounds, and the 3/8-inch, 6 1/2 pounds. The reduction gearing has ample wearing surface and the spindles run in ball bearings. A Jacobs chuck is furnished as standard equipment. Each drill may be dismantled by removing four bolts. A new grinder will also be shown at the exposition.

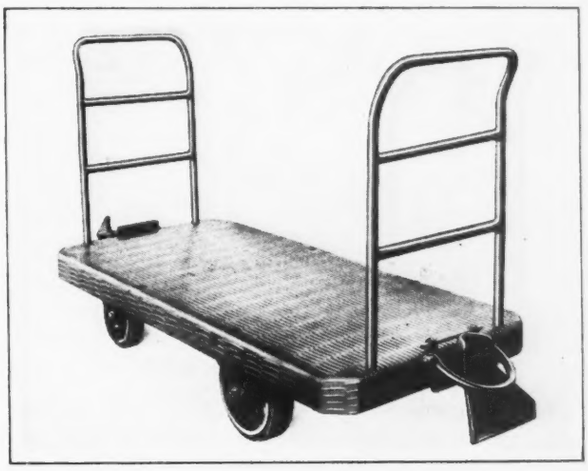


Rotor Air Drill of New Design

CLARK STEEL TRAILER

Detroit Exposition, Booth No. 412

A steel trailer equipped with rubber-tired wheels, ball and roller bearings, and automatic couplers has been placed on the market by the Clark Tructractor Co., Battle Creek, Mich. This trailer is of standard warehouse and shop size, and has a platform 3 by 6 feet long, formed from a single piece of diamond plate steel, 1/4 inch thick.



Clark Warehouse Size Steel Trailer

The diamond design, which prevents the load from slipping, the rubber tires, and the automatic couplers which permit the driver to couple and uncouple the trailer without dismounting, are features that insure safety and speed of operation. Adjustable interchangeable racks for use on the ends or sides are provided.

The casters swivel on eighteen 1-inch steel balls, and there is a Timken bearing in the king-pin location. The wheels are mounted on roller bearings of special design. The size of the rear tires is 12 by 4 inches and of the caster tires, 10 by 3 inches. The weight of the complete trailer is 550 pounds.

GEOMETRIC SELF-OPENING DIE-HEADS

Cleveland Exposition, Booth No. 815

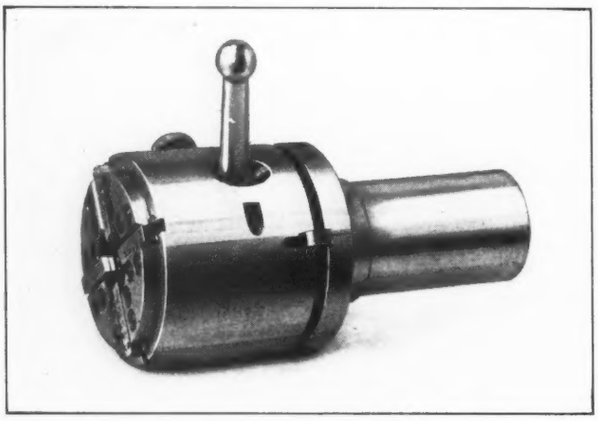
A new line of stationary self-opening die-heads for use on hand screw machines, turret lathes, etc., has recently been brought out by the Geometric Tool Co., Westville Station, New Haven, Conn. This new line of tools, known as style KH, takes the same type of chaser as the Geometric style K and KD heads described in MACHINERY for

April, 1925, and September, 1926, respectively. The interchangeability of the chasers in these different styles of heads permits cutting threads on various types of machines with but one stock of chasers.

The new die-heads are simple in construction and operation. The only screws in the tool are those in the front plates, and it is not necessary to remove these when disassembling the die-head. The die is opened and closed axially, the opening action being accelerated by two straight springs. The locking mechanism consists of a pawl having a broad contact surface.

By simply pulling up the spring stop plunger when the die-head is in the open position, the chasers can be withdrawn with the fingers. Size adjustment is obtained by imparting a fraction of a turn to the adjusting ring on the back of the head, the setting being locked by a spring pin.

The chasers are backed up directly behind the cutting point by a heavy closing sleeve. They are also rigidly supported on both sides and bottom,



Geometric Stationary Self-opening Die-head

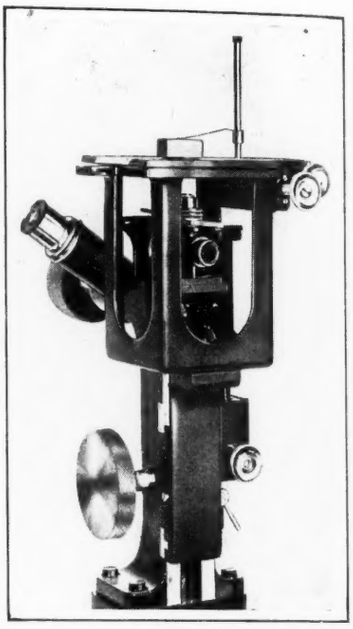
with a supplementary support along the top, by the front plate which extends over a step on the chasers. This style KH die-head is built in five sizes, with a cutting range for straight threads from 1/8 inch to 3 1/2 inches and standard pipe threads from 1/8 inch to 3 inches.

BAUSCH & LOMB METALLOGRAPHIC EQUIPMENT

Detroit Exposition, Booth No. 341

A number of improvements have recently been incorporated in the model GBILSAA metallographic equipment manufactured by the Bausch & Lomb Optical Co., 662 St. Paul St., Rochester, N. Y., with a view to making it a reliable and convenient apparatus.

The optical system is aligned at the factory and all adjustments are removed on this part of the apparatus. The difficulty of securing satisfactory metallurgical photomicrographs under extremely high magnification, due to the change of focus during exposure, resulting from the expansion of the materials of the apparatus under the heat from the source of illumination, has been entirely eliminated. This has been accomplished by making the new microscope in three distinct parts, and so mounting these parts that (1) no metal part subject to the direct heat of the illuminant is used in focussing; (2) the weight of the specimen is placed on a sturdy support which can be locked in position before the fine focussing is undertaken; and (3) the fine focussing adjustment is entirely free both from the effects of heat from the illuminant and from the weight of the specimen. In addition, a movable metal shield is so mounted that no light other than the direct centered beam reaches any part of the microscope.



Improved Bausch & Lomb Metallographic Equipment

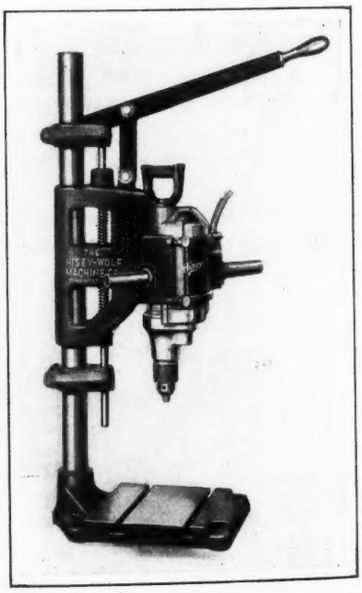
Another improvement consists in the elimination of vibration between the various units (camera, microscope, and illuminant) through the rugged construction of the bed and the broad bearing surfaces and locks that hold them in position. The only other possible vibration is between the parts of the microscope itself. The broad bearing surface of the coarse adjustment slide, together with its lock, prevents vibration between these two; and in addition, the upper part of the stage has a double milled slide which is under spring pressure from a fixture fastened directly to the base of the instrument, so that the stage is always supported at the top and bottom with respect to the optical parts of the instrument.

HISEY DRILLING STANDS

Cleveland Exposition, Booth No. 108

Drilling stands for bench, post, or wall mounting of portable electric drills have been brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The accompanying illustration shows the bench drilling stand. A similar arrangement with brackets at top and bottom is available for wall or post mounting.

These drilling stands are made for all sizes of Hisey electric drills from 1/4 to 7/8 inch capacity. They are so designed that the drills can be attached without removing any part. This feature



Hisey Bench Drilling Stand

saves time and protects against loss of parts. The bracket and the electric drill housing are accurately machined to insure alignment of the drill in the stand.

GAIRING BORING AND REAMING TOOLS

Cleveland Exposition, Booth No. 505
Detroit Exposition, Booth No. 243-A

New inserted-blade tools have been developed by the Gairing Tool Co., 19 W. Woodbridge Ave., Detroit, Mich., for boring operations (Fig. 1), and reaming operations (Fig. 2), which can be adapted

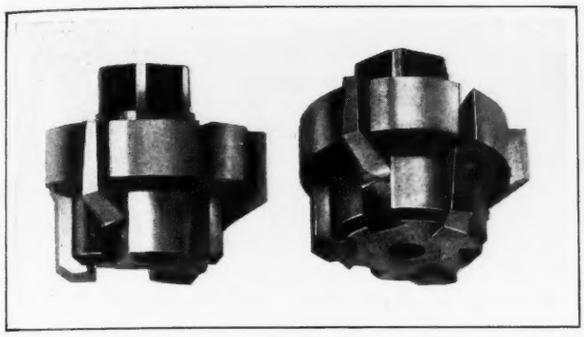


Fig. 1. Gairing Inserted-blade Multiple Boring Tool

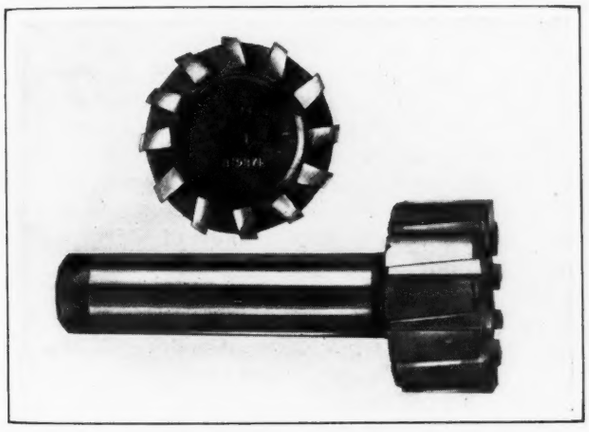


Fig. 2. Inserted-blade Reamer with Drive Shank

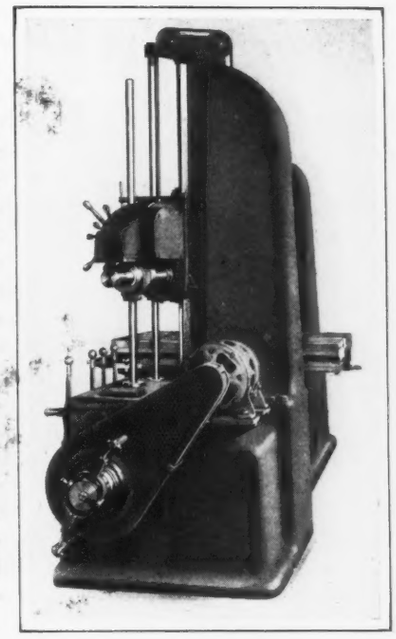
to the Gairing standard drive. The high-speed steel blades are driven into the body and held entirely by friction, a double angle causing the blades to tighten in place.

A feature of these tools is that the blades have a bearing on the bottom and on both sides of dovetail slots. A large range of adjustment can be had by using shims to bring the blades out to the desired diameter and length. Grinding is then done in the same way as with other types of adjustable tools. The bodies are made from vanadium steel. These tools can be made from 1 1/4 inches in diameter up to any size desired.

TRI-WAY UNIVERSAL BORING MACHINE

Cleveland Exposition, Booth No. 219

A No. 24 "Tri-Way" horizontal heavy-duty boring machine has recently been placed on the market by the Universal Boring Machine Co., Hudson, Mass. This boring machine has been designed to cover a large vertical range and to provide maximum boring and milling capacity when operated at the limit of travel. To provide this increased capacity, a heavy-duty head and rear posts have been designed of sufficient size and strength to resist the strains set up by boring and milling operations. The main driving clutch and the clutch for reversing the spindle are of large capacity to transmit the required power. The machine is equipped with 3-inch spindles.



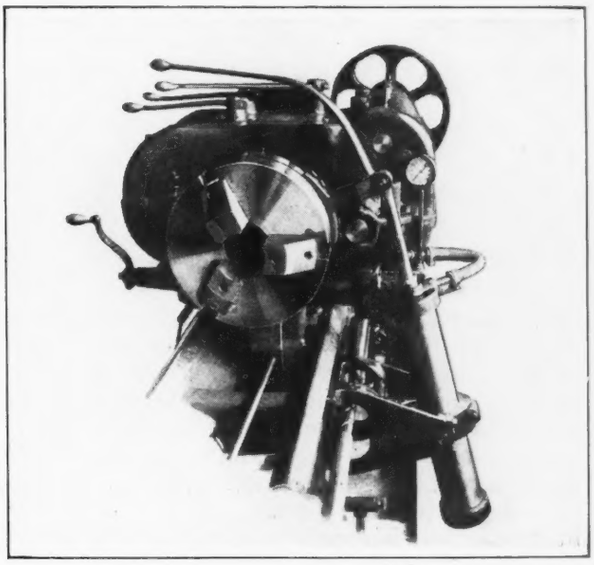
Heavy-duty "Tri-Way" Universal Boring Machine

This new design is made in a variety of bed and table sizes and with different vertical head travels, as may be required by individual manufacturing plants. The machines vary in weight from 14,500 to 17,400 pounds.

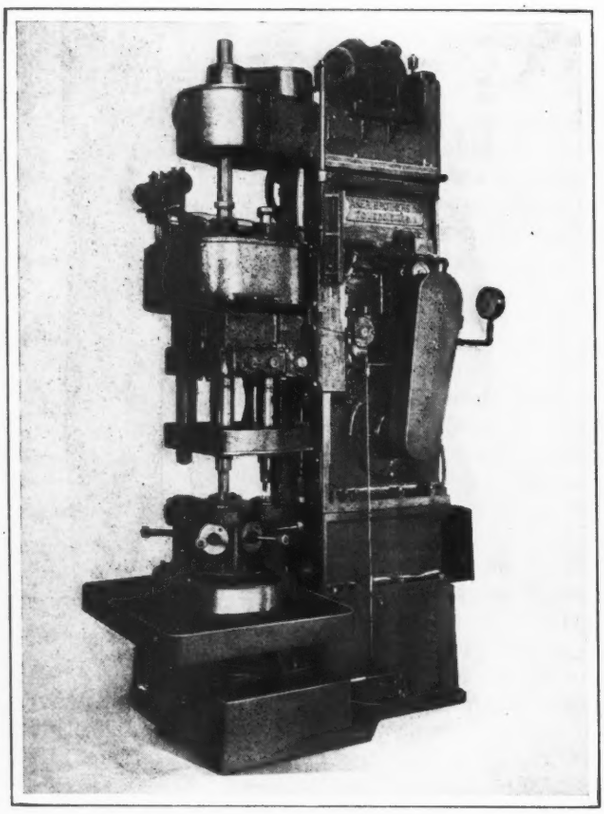
FOSTER-BARKER CHUCK

Cleveland Exposition, Booth No. 320

The Foster Machine Co., Elkhart, Ind., has designed and placed on the market the hydraulically operated Foster-Barker chuck which is shown in the accompanying illustration applied to a No. 3-B universal turret lathe built by the same company. The ordinary lubricant pump regularly supplied with the machine for pumping coolant to the tools supplies the cutting lubricant under pressure to the operating cylinder of the chuck, through a control valve operated from the front side of the machine.



Foster-Barker Hydraulically Operated Chuck Applied to a Turret Lathe



Baker Hydraulic-feed Boring and Drilling Machine

BAKER BORING AND DRILLING MACHINE

Cleveland Exposition, Booth No. 821

A No. 25 hydraulic-feed boring and drilling machine of a production type is the latest development of Baker Bros., Inc., Toledo, Ohio. This machine can be furnished in a variety of styles to suit the work to be done. The basic features are a direct-geared motor drive for the spindles in the head and a hydraulic Oilgear attachment for driving the feed mechanism. The machine is of the sliding saddle type, and the feed cylinder is cast integral with the saddle. The Oilgear pump is installed inside the frame of the machine, and driven by a 1 1/2-horsepower motor, also within the frame.

The feed is engaged by depressing a foot-treadle. This actuates a rapid traverse which changes to the proper cutting feed at any predetermined point, and, finally, to an automatic quick return. The rate of feed for the cutting operation is variable and readily changed by a lever. The point at which the rapid traverse changes to the cutting feed and the point at which the quick return starts are controlled by cams on the saddle, which can readily be changed to any position within the feed range of the machine.

The heads are usually made special to suit the work. The machine can be furnished as a single-spindle unit or with multiple spindles for machining more than one piece at a time, or for performing successive operations on the same piece. The illustration shows a machine equipped with a five-spindle head and six-station table for performing successive operations on a steering gear housing.

In all multiple heads, there is a vertical adjustment for each spindle to take care of tool grinding and wear. The main motor is mounted on top of the machine away from dirt and chips. Any desired height between the spindle and base can be obtained by the use of spacer blocks.

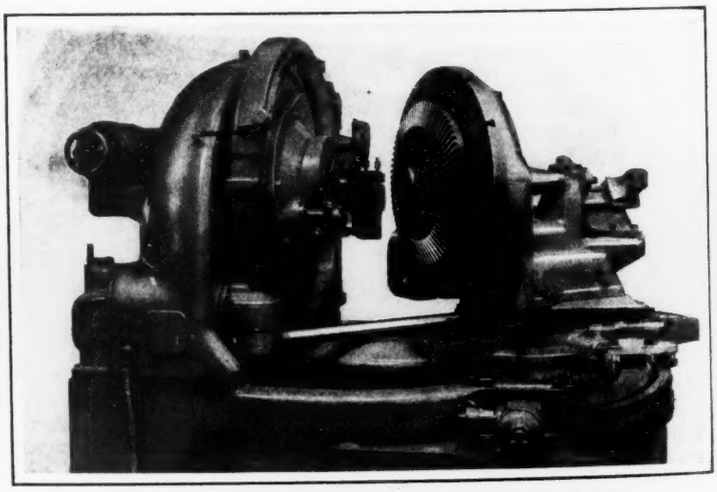
GLEASON SPIRAL BEVEL GEAR PLANING GENERATOR

Cleveland Exposition, Booth No. 208

Large spiral bevel gears are generated with a single planing tool in a new type of machine just developed by the Gleason Works, Rochester, N. Y. This machine has a capacity for gears up to 60 inches in diameter with a 10 to 1 ratio, and up to 42 inches in diameter with a 1 to 1 ratio. The spiral angle of the teeth can vary from 0 to 30 degrees. Index change-gears are provided for gears having from 12 to 180 teeth, not including prime numbers above 100. The machine is practically universal within its range, except for slight limitations between the spiral angle and the cone distance. Claims made for the new machine include speed of operation and the production of gears of higher accuracy and quieter running qualities.

Machines previously built by the company for cutting bevel gears over 40 inches in diameter were all of the planing-forming type in which the tooth profile curve is obtained by a direct copying process. In the new machine, the same generating principle is used as in the smaller Gleason straight-bevel and spiral-bevel gear generators. The tool is carried on a cradle which rotates slowly and the tool, in effect, represents a tooth of a crown gear. Relative motion occurs between the blank and the tool similar to the rolling together of the gear with a crown gear. By this process, a tool with a straight cutting edge automatically produces the correct profile curves on the teeth.

The tool-slide is reciprocated by a simple crank drive of adjustable stroke, while the gear blank rotates continuously at a uniform rate. During one revolution of the blank, the tool makes as many strokes as the number of teeth in the gear. The cradle on which the tool-slide is carried is given a slight rocking motion to obtain the desired lengthwise curvature across the gear face. The



Gleason 60-inch Planing Generator for Spiral Bevel Gears

spiral angle is controlled by offsetting the tool-slide from the center of the cradle, this slide being mounted on a movable arm which can be swung about the center of the crank.

Gear blanks are first roughed out with slotting and V-tools, after which the teeth are finished with straight-edged tools working on one side at a time. The same pair of finishing tools can be used for a considerable range in pitch. During each return stroke, the tool is lifted entirely out of the cut. The head on which the blank is mounted is double-ended, one end being used for cutting gears and the other for cutting pinions. As the head is built on a pivoted base, the operator can easily swing either end into position for an operation.

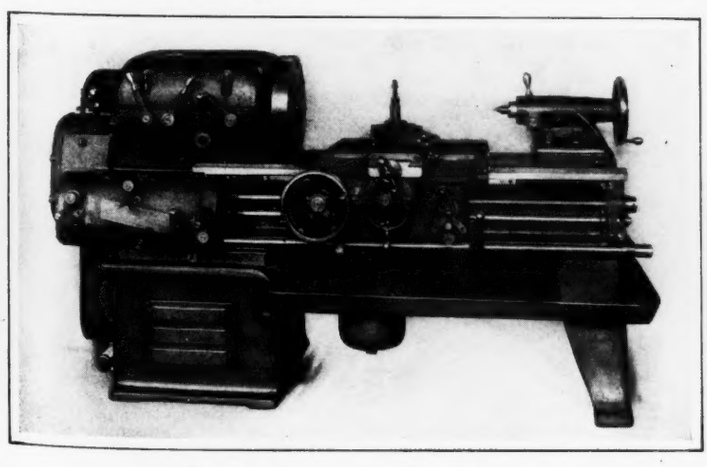
A direct-connected constant-speed 10-horsepower motor furnishes the drive. Change-gears provide for various speeds. The machine is automatically lubricated, except for a few hand oilers.

REED-PRENTICE GEARED-HEAD LATHE

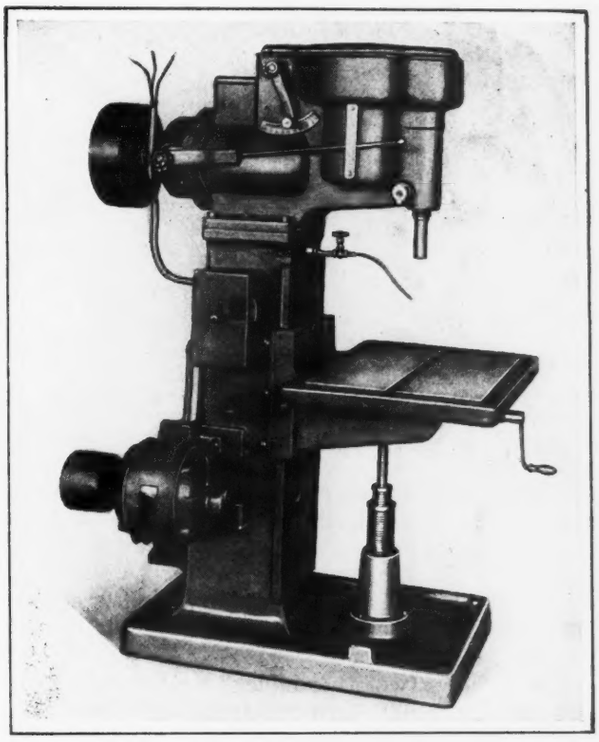
Cleveland Exposition, Booth No. 828

A heavy-duty 14-inch geared-head lathe, recently added to the line manufactured by the Reed-Prentice Co., Worcester, Mass., is here illustrated. This machine actually swings 16 1/2 inches over the bed and 10 inches over the compound rest. The maximum distance between centers is 30 inches with the standard 6-foot bed. Sliding gears in the headstock give eight spindle speeds ranging from 16 to 384 revolutions per minute, there being only nine gears. The speed changes are accomplished by means of levers at the front of the headstock. The quick-change gear-box gives feeds ranging from 0.0025 to 0.160 inch per revolution, and 55 threads, from 2 to 128 per inch, may regularly be cut. Provision is made for obtaining additional threads.

A motor drive through a belt is provided by either a three- or five-horsepower motor mounted within the cabinet leg, an adjustable spring idler insuring proper belt tension. There are two levers for starting and stopping the friction clutch and for controlling the brake. One of these is located just beneath the headstock and the other at the right of the apron. Cross and longitudinal feed changes are made through a lever on the apron. The carriage is arranged to receive a taper attachment and other attachments. An oil pan, pump, and piping can be supplied.



Reed-Prentice Production Geared-head Lathe



Gaterman Improved Pneumatic Oscillating Tapper

GATERMAN PNEUMATIC TAPPER

Detroit Exposition, Booth No. 253

An improved pneumatic oscillating tapping machine has been brought out by the W. Gaterman Mfg. Co., Franklin and 15th Sts., Manitowoc, Wis. This machine has a box-type column construction and a six-speed geared transmission. The speed change transmission is contained in the horizontal barrel of the machine, as may be seen in the accompanying illustration, and the forward and reverse clutch transmission in the vertical barrel. Each transmission is a complete unit, which can be removed separately, if necessary.

An advantage of this construction is that in shops where the machine is installed, an extra set of units can be carried in stock, and if anything should happen to the machine, it would only take a few minutes to remove a unit and replace it by the emergency set.

The entire mechanism operates in a bath of oil, and twenty-two Timken roller bearings carry the radial and thrust loads of the revolving parts. The machine has a capacity for from 1/4- to 1 1/4-inch U. S. standard taps, in steel. The weight of the machine is 1500 pounds.

WALKER MAGNETIC CHUCKS

Cleveland Exposition, Booth No. 125

Magnetic chucks of the design illustrated in Fig. 1 are made to any length by the O. S. Walker Co., Inc., Worcester, Mass. The particular chuck illustrated has one coil which, when energized, develops magnetism at the same time in both the vertical and horizontal faces. It is 9 1/2 inches high by 9 1/2 inches wide. This chuck design is well adapted for use in grinding knife bars and similar work, where it is desired to grind both sides and

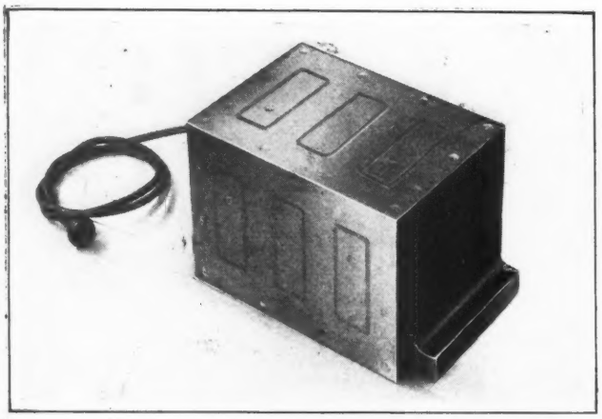


Fig. 1. Walker Magnetic Chuck Made to Any Length

edges without disturbing the setting of the chuck. Heavy shear blades, where the edges are finished at right angles to the sides, constitute a typical example. A chuck of this type, 84 inches long, was recently built. This chuck has seven coils, requires 735 watts for operation, and weighs about 1650 pounds.

Fig. 2 shows two other chucks made by the same company, in which both the front and back faces become magnetically active when the coil is energized. The particular chucks illustrated are 11 inches high by 14 inches long and are used vertically as shown. Several of these chucks are placed in line for holding channels on the table of auto-

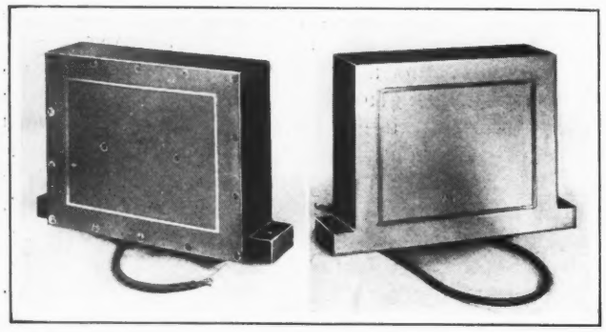


Fig. 2. Chucks which are Magnetized Both Front and Back

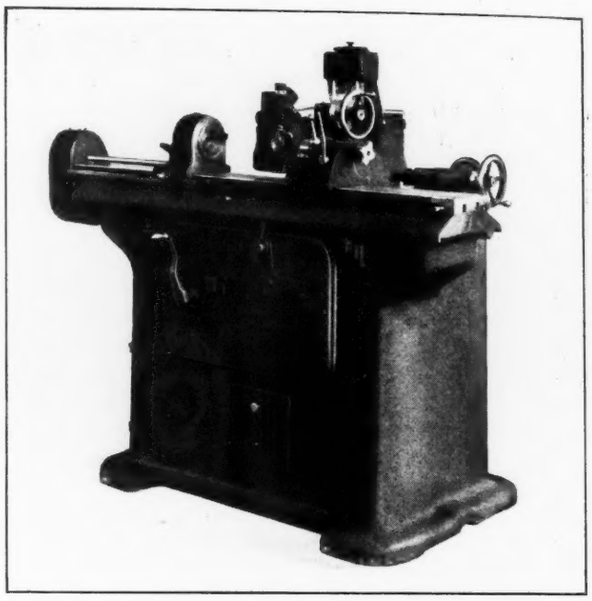
matic drilling machines. Chucks can, of course, be made with a variety of divisions on their faces. Each chuck weighs about 165 pounds.

BARBER-COLMAN SYSTEM FOR CONTROLLING REAMED WORK

Cleveland Exposition, Booth No. 313

In sharpening reamers for service where a high degree of finish and accuracy is desired, it is ordinarily necessary to stone the reamer cutting edges by hand to enable them to produce the required results. With a view to eliminating this hand operation, the Barber-Colman Co., Rockford, Ill., has brought out a system of reamers and a sharpening machine which enable the high finish and the necessary degree of accuracy to be obtained without hand work. The reamers are designed to be in step with the machine during the process of sharpening—hence, one cannot be used without the other.

The development is based upon an accumulation of data covering the amount of diameter cutting clearance, form of reamer nose, etc., to take care of different materials and hardness conditions met with in different classes of reaming. As a result, reamers best suited to their work may be produced, and the reamer and sharpening machine are so tied together that it is possible to hold all reamer dimensions to close limits, set to suit the required size and finish of the reamed hole. The accom-



Barber-Colman Machine for Reamer Sharpening

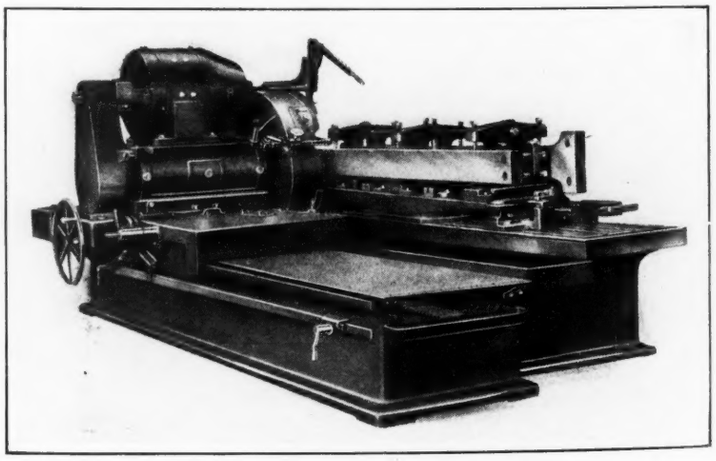
panying illustration shows the reamer grinding machine, which will be in operation sharpening reamers at the Cleveland Exposition.

STATIONARY WORK-TABLE GRINDER

Cleveland Exposition, Booths No. A-23 and A-25

A grinding machine having a stationary work-table and a traveling grinding wheel is the latest development of the Machinery Co. of America, Big Rapids, Mich. By means of the stationary table, work can be clamped on one side while parts on the other side are being ground. Other advantages claimed for the construction include speed of operation and convenience of loading and unloading.

The illustration shows the machine equipped



Grinder Built by the Machinery Co. of America

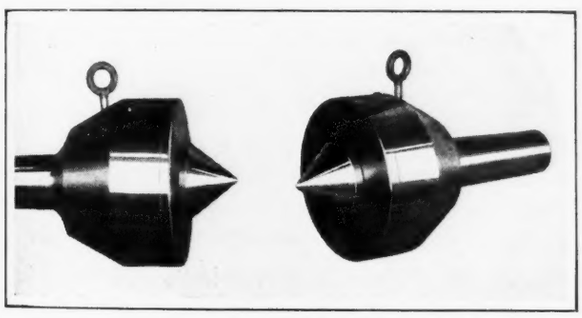
with a swiveling work-holder designed for locomotive guide bars. After one guide bar has been ground, the holder is swiveled on ball bearings to bring another guide bar into the grinding position. The holder is then clamped ready for grinding. With this arrangement, the grinding continues with only a few seconds interruption.

The machine has a capacity for work up to 84 inches in length and 20 inches in height. A 25-horsepower motor running at 1200 revolutions per minute drives the grinding wheel spindle through a Link-Belt silent chain. Wheel speeds from 450 to 500 revolutions per minute are obtainable, while the carriage may be fed at 12, 17, or 24 feet per minute. Feed changes from 0.0005 to 0.005 inch are made automatically at both ends of the carriage travel. Cross-feeding of the wheel by hand may be accomplished from the front of the machine. Feed changes are made from either the front or back. Automatic lubrication is furnished to most bearings and ways. The wheel is 30 inches in diameter, and the machine weighs 17,000 pounds.

KELLY ROLLER-BEARING CENTERS

Cleveland Exposition, Booth No. 605
Detroit Exposition, Booth No. 308

The Kelly Reamer Co., Cleveland, Ohio, has recently developed a complete line of roller-bearing live centers for normal and heavy-duty work. The accompanying illustration shows a pair of these



Roller-bearing Live Centers Made by the Kelly Reamer Co.

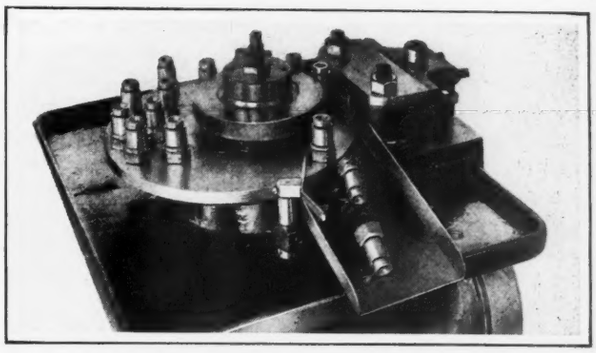
centers made primarily for railroad shop use. Each employs two Timken tapered roller bearings, which are mounted in such a way that any necessary adjustment for wear can be simply made.

NOBLE & WESTBROOK MARKING MACHINE

Detroit Exposition, (Acme Stamp Co.'s Booth)
New Haven Exposition, Booth No. 203

A machine has been developed by the Noble & Westbrook Mfg. Co., Hartford, Conn., for rapidly marking spark plugs, screw machine parts, bushings, and similar articles having sufficient body to be marked without being crushed. The illustration shows the machine being used in marking spark plugs on the round surface. A production of 125 pieces per minute is obtainable.

A central rotating dial furnishes pressure to carry the work across the lettering die. A loading table carries the work forward to the dial and marking position, the table revolving much slower than the pressure dial and thus giving ample time for the operator to load it. The work is placed in any convenient position on the table. After being



Noble & Westbrook Rapid-production Marking Machine

marked, the parts are unloaded by a simple fixture into a chute which carries them to a receptacle.

The lettering die is mounted in a holder which can be raised or lowered so as to place the mark in the desired location. The pressure dial can be raised or lowered to correspond with the die. This machine is driven by a 1/4-horsepower motor and weighs about 425 pounds.

GALLMEYER & LIVINGSTON SURFACE GRINDER

Cleveland Exposition, Booth No. 623

A No. 4 surface grinder equipped with an Oilgear hydraulic feed has recently been added to the line made by the Gallmeyer & Livingston Co., 344 Straight Ave., S.W., Grand Rapids, Mich. With this hydraulic drive, no gears are required for the movement of the saddle and table and an infinity of feed ranges is available from almost nothing to 55 feet per minute. With each reversal of the reciprocating table, the hydraulic equipment actuates the cross-feed mechanism. It can be set to operate at each end of the reciprocating table stroke or at one end only, and to feed either in or out. The amount of cross-feed for each reciprocation of the table is also adjustable.

The spindle head has a vertical movement of 13 3/4 inches, and carries the spindle in bronze

Gallmeyer & Livingston Hydraulic Surface Grinder

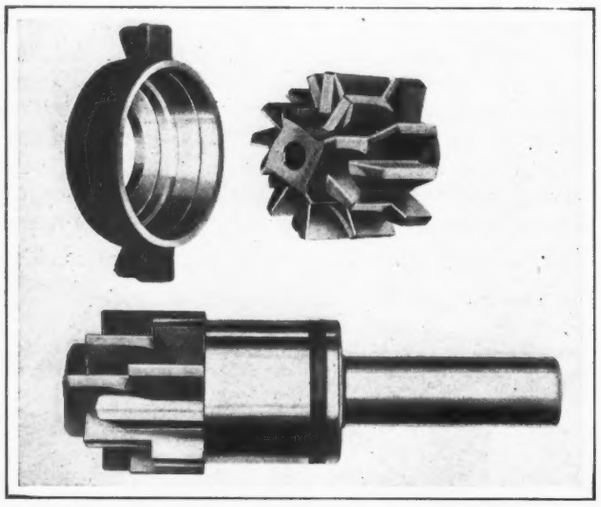
bearings which have a convenient means for taking up wear. The large handwheel shown is used for making rapid adjustments when raising or lowering the wheel-head a considerable distance, this handwheel being graduated to 0.00025 inch. However, when it is desired to get very accurate settings for grinding to close limits, the small knurled knob in the center of the handwheel is employed in conjunction with the graduated disk, which is also in the center of the handwheel. This disk is graduated to 0.0001 inch with the graduations over 1/8 inch apart.

The standard spindle construction provides for carrying wheels 10 inches in diameter by either 3/4 or 1 inch in face width, but variations can be made. The particular machine illustrated is driven by a motor contained in the base, and the machine is arranged for dry grinding only. However, it is also built with wet grinding equipment and with a dust collecting system for dry grinding. The automatic longitudinal table travel is 26 inches, and the transverse travel, 11 1/2 inches; the working surface of the table is 10 by 24 inches; the maximum distance from the wheel to the table under a 10-inch wheel is 12 1/4 inches, and under a 7-inch wheel, 13 3/4 inches; and the weight of a motor-driven machine arranged for dry grinding without accessories is approximately 4025 pounds.

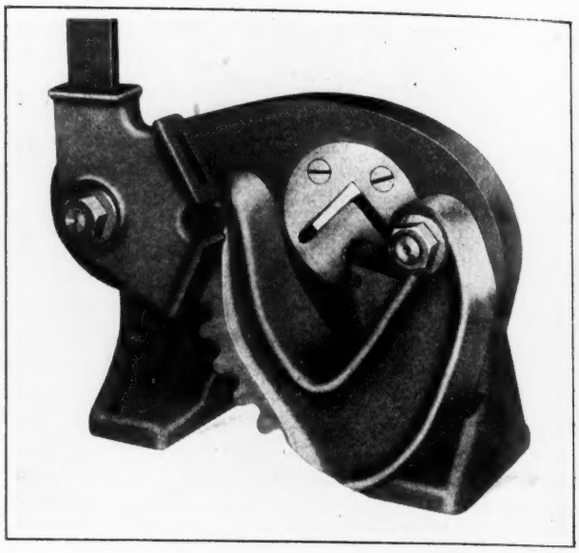
ECLIPSE "MULTIDIAMETER" CUTTER

Detroit Exposition, Booth No. 216

Multiple-operation or "Multidiameter" cutters are manufactured by the Eclipse Interchangeable Counterbore Co., Detroit, Mich., for simultaneously taking a number of cuts on one piece of work. The illustration shows an eight-operation cutter which faces three surfaces, core-drills one hole, bores three holes, and chamfers one surface, all at one pass of the tool. This cutter was designed for machining clutch housings for G. M. C. trucks. It is stated that the use of this cutter has eliminated one machine, five cutters, and the labor cost of one man, as well as cutting the production time in half. The holes bored range from 3.156 to 3.628 inches in diameter.



Multiple-operation Cutter Designed for Clutch Housings



No. 62 Whitney Angle-iron Shear

WHITNEY ANGLE-IRON SHEAR

Detroit Exposition, Booth No. 251

What is known as the No. 62 angle-iron shear has recently been placed on the market by the Whitney Metal Tool Co., Rockford, Ill. This shear is similar in appearance and operates on the same principle as the No. 4 shear built by the same company, but it is heavier, and has a capacity up to 3- by 3- by 1/4-inch angle-iron.

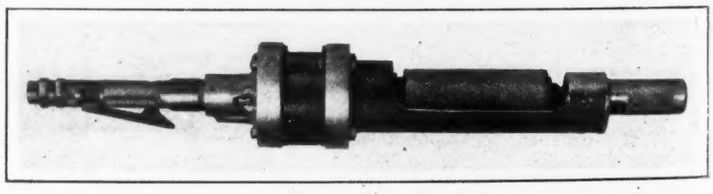
The shear is provided with an eccentric gear, so that the leverage pressure is equally distributed over the entire cutting blades. There is also an adjusting screw provided, so that all angle-irons can be cut off squarely. A self-clamping pad is used for holding the angle-irons in position. A flat bar handle, milled to fit the socket, is furnished with each shear.

BUCKEYE PORTABLE AIR-OPERATED SURFACE GRINDER

Cleveland Exposition, Booth No. A-9

A No. 63 portable air-operated flat surface grinder has recently been brought out by the Buckeye Portable Tool Co., 131-135 Wayne Ave., Dayton, Ohio. This grinder was designed primarily for rapidly and economically polishing and grinding the side rods of locomotives, but it can also be used for grinding and polishing flat surfaces of other parts.

The tool is 27 inches long over-all, and 4 1/2 inches in diameter at the largest section; it has a spindle speed of 6000 revolutions per minute, and weighs 15 pounds complete. The capacity is for polishing surfaces from 6 to 9 inches in width. This tool, like all the other tools of the "Hercules" line made by this company, is driven by a rotary



Buckeye Portable Grinder for Polishing and Grinding Flat Surfaces

air motor which employs no pistons or connecting-rods. There are but four moving parts.

When in use, the tool is gripped by the operator with both hands, and the wheel held over the part to be polished. The air motor is started by pressing on the safety control valve in the handle near the end where the air enters the tool from the supply line.

OESTERLEIN TILTED OFFSET MILLER

Cleveland Exposition, Booth No. 516

A 48-inch tilted miller has been brought out by the Oesterlein Machine Co., Cincinnati, Ohio, for finishing small parts by a process known as "offset milling." Such operations as face or straddle milling, the milling of flats and slots, and the taking of saw cuts may be advantageously performed by the process. A production advantage is derived from the fact that a number of parts may be cut simultaneously all of the time.

The offset miller has a tilted circular table in which there is a large center hole. A spindle is mounted beneath and at right angles to the working surface of the table. A 4-inch offset adjustment is provided for the table so that the table and spindle center lines may be made to coincide for the removal of work-holding fixtures, or may be offset the required distance to obtain the proper depth of cut. The spindle is mounted in a slide which is bolted to the same housing that carries the table and which also carries the arbor support. There is a 2-inch vertical spindle adjustment for setting the cutters properly relative to the work.

The spindle is driven by a worm-wheel, 15 inches in pitch diameter, which floats on the spindle and is carried in a bronze bearing. By mounting the spindle below the table, the drive has been brought as close as possible to the spindle nose. Another advantage is that arbors or cutters can be removed without disturbing the vertical setting.

Oesterlein Tilted Offset Miller

The table is 30 inches in diameter and is mounted in a tilted position. The feature claimed for this construction is that the table sheds 40 gallons of coolant per minute without splashing, and washes away all chips into a retaining cavity in the base. This machine swings work up to 48 inches in diameter and takes work up to 14 inches high between the table and the housing top. A 10-horsepower motor is recommended for driving the machine to capacity. The net weight of the machine is about 7000 pounds.

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RECOMMENDED PRACTICE FOR FORGED AND ROLLED CARBON STEEL FOR GEARS

The recommended practice for forged and rolled carbon steel gears, details of which are given in the following, has been approved by the American Gear Manufacturers' Association and the American Society of Mechanical Engineers.

Material Covered—This specification covers steel for gears in three groups, according to heat-treatment, as follows—(a) casehardened gears; (b) unhardened gears, not heat-treated after machining; and (c) hardened and tempered gears.

Basis of Purchase—Forged or rolled gear steels shall be purchased on the basis of the requirements as to chemical composition specified in the accompanying table. Requirements as to physical properties have been omitted, but when they are given, requirements as to carbon content shall be omitted.

Manufacture

Process—The steels may be made by either the open-hearth or electric furnace process.

Discard—A sufficient discard shall be made from each ingot to secure freedom from injurious piping and undue segregation.

Chemical Composition for Forged and Rolled Carbon Steel for Gears

Use	Class	Carbon	Manganese	Phosphorus	Sulphur
Casehardened..	C	0.15 to 0.25	0.40 to 0.60	Maximum 0.045	Maximum 0.05
Untreated*....	N	0.25 to 0.50	0.50 to 0.80	Maximum 0.045	Maximum 0.05
		0.40 to 0.50	0.40 to 0.60	Maximum 0.045	Maximum 0.05
Hardened.....	H	0.40 to 0.50	0.40 to 0.60	Maximum 0.045	Maximum 0.05

Machinery

*Class N steel will normally be ordered in 10-point carbon ranges within these limits.

Chemical Composition—This is given in the accompanying table.

Derivation—Class C is S.A.E. 1020, excluding the lower ten points of manganese range. Class N is S.A.E. 1030, 1035, 1040, and 1045, along with the 0.45 carbon steel specified in Class H. Class H is similar to S.A.E. 1046 or 1045 but with a modified manganese range.

Ladle and Check Analyses

An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of the elements specified. This analysis shall be made from drillings taken at least 1/4 inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified.

Analyses may be made by the purchaser from one or more bars or forgings representing each melt. The chemical composition thus determined shall conform to the requirements specified in the table. Drillings for analysis shall be taken at any point not closer to the center than midway between the center and the surface, but not within 1/4 inch of the surface of the bar or forging.

Finish, Marking, and Inspection

The material shall be free from injurious defects and shall have a workmanlike finish. Cold-finished bars shall have a bright smooth surface.

The melt number shall be legibly stamped on each bar or forging 4 inches or over in thickness, and on those of smaller section when so specified. The number stamped on gear blanks shall be placed on the web or in such position that it will not be obliterated in machining operations.

The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with the specifications.

(a) Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported within ten working days from the receipt of samples.

(b) Material that shows injurious defects while being finished by the purchaser will be rejected, and the manufacturer shall be notified.

Samples tested in accordance with this specification that represent rejected material shall be preserved for two weeks from date of test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Users requiring a 0.45 per cent carbon steel to withstand a drastic quench may add the following sentence, which is not a part of the general specifications: "In class H only, the combined manganese and carbon shall lie between a lower limit of 0.85 per cent and an upper limit of 1.05 per cent."

* * *

FRENCH INDUSTRIAL CONDITIONS

According to a report to the Department of Commerce by Assistant Trade Commissioner Franklin P. Waller, Paris, the French industrial machinery field during 1926 was characterized by a new production record and the maintenance of a high export level. The only complete statistics on the French production of industrial machinery are for the pre-war year 1913, when the production was valued at $45,000,000. It is estimated that in 1925 the output measured in gold value was more than two and one-half times the output of 1913. In 1926, the volume was somewhat in excess of that for 1925. The production of machine tools in 1913 amounted to about $2,000,000. In 1925, it was estimated at a value of $7,000,000, with a slight increase in 1926.

Exports of industrial machinery rose to new record levels during the past year, amounting to over 100,000 tons, with imports amounting to 72,500 tons. In 1913, the imports of industrial machinery amounted to 126,000 tons, and exports to 27,000 tons. This great change in conditions should be noted. Instead of being chiefly an importing country of machinery, France has taken a position as an important exporter, while at the same time the domestic needs are largely supplied by domestic production. Of the imports, Germany supplied 28 per cent; Great Britain, 20 per cent; and the United States, 18 per cent.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

CINCINNATI BRAKE-DRUM GRINDER

An electrically controlled machine recently brought out by Cincinnati Grinders, Inc., Cincinnati, Ohio, for grinding brake-drums has a production rate of one piece per minute or a floor-to-floor rate of 40 to 45 pieces per hour. The production of brake-drums from a high-grade steel and their heat-treating has brought about the necessity of finishing them by the grinding method. Where the drums are produced within close limits of accuracy by the dies, it is possible to finish them from the "black" by grinding. It is the practice of some manufacturers, however, to turn the drums after they have been heat-treated, and this, of course, facilitates the grinding, as there is less stock to be removed by the latter operation.

The entirely self-contained grinder is shown in Fig. 1 with a brake-drum mounted in place. The 30-horsepower motor which drives the grinding wheel spindle is built into the machine. Smooth operation of the spindle is insured by the "Texrope" drive employed. The spindle of the machine is of heavy design and intended to carry a wheel 14 inches in diameter with a 3-inch face. The weight of the machine is 12,500 pounds.

Work is held on the faceplate by means of air chucks. The accurate sizing of work is facilitated by a dial gage permanently located in position. The truing tool is also permanently located. The two-horsepower work-head motor is of the variable-speed type and is controlled by a conveniently located rheostat.

Starting and stopping of the work-rotating spindle is accomplished through a push-button control. A dynamic brake serves to stop the rotation of work instantly. The work-saddle is provided with an adjustable dead stop to facilitate locating the work with respect to the grinding wheel. The operating position is just in front of the grinding wheel where the contact of the wheel with the work can be observed. A coolant tank is built in the machine and contains a pump which is kept primed at all times. When direct current is not available, a generator may be attached to the lower portion of the base, as shown in Fig. 2.

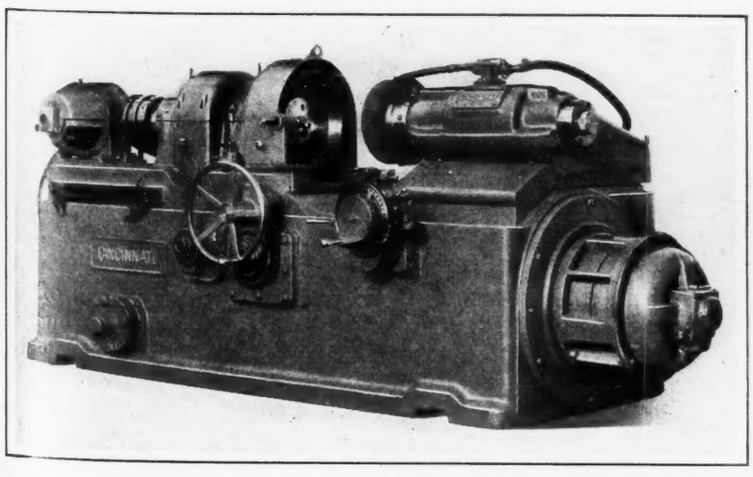


Fig. 1. Cincinnati Brake-drum Grinder with Work Held by Air Chuck

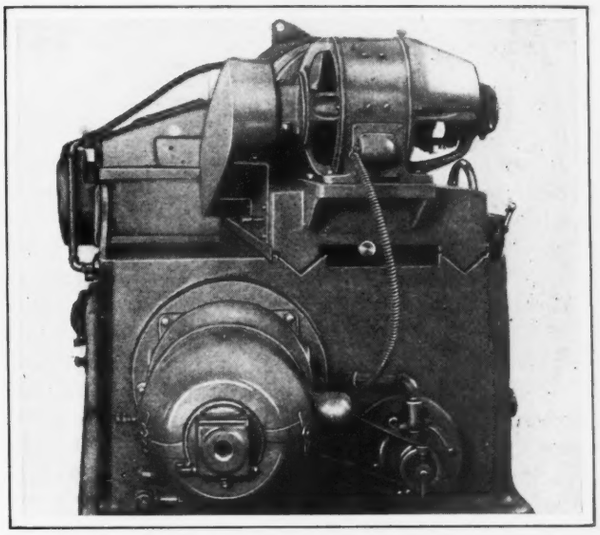


Fig. 2. Generator Used when Direct Current is not Available

The brake-drum shown on the machine in Fig. 1 is 18 inches in diameter and has a 3-inch face. In this case, 0.008 inch of stock is removed by the grinding wheel at the rate of 1 minute per drum, actual grinding time, the normal hourly production rate ranging from 40 to 45 drums. The previous production time obtained on this work was 10 pieces per hour.

MICRO INTERNAL GRINDER AND LINK GRINDING ATTACHMENT

A heavy-duty internal grinder has recently been placed on the market by the Micro Machine Co., Bettendorf, Iowa. This machine has a capacity for grinding holes from 5 to 36 inches in diameter by 60 inches deep. The total eccentric throw of the grinding spindle is 4 inches, and this can be increased to 10 inches by a special double eccentric design. The main table is 114 inches long by 30 inches wide, the full length and width of which may be utilized for mounting work. The total table travel is 63 inches; the distance from the top of the table to the center of the grinding circle, 24 inches; and the height of the spindle from the floor, 60 inches. A 15-horsepower motor, rotating at 1750 revolutions per minute is used. The floor space required for the machine is 6 by 22 feet, and the net weight of the machine is 25,000 pounds.

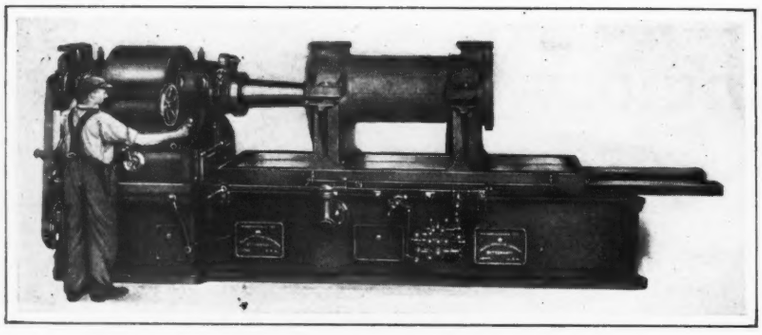


Fig. 1. Micro Heavy-duty Internal Grinding Machine

A variable-speed drive is provided for the main spindle, adjustable to the diameter of hole being ground. The speed change is instantly accomplished from a graduated dial in front of the headstock. The main table is hydraulically driven, and is controlled by one operating lever. A wide range of feeds, including a rapid traverse, is obtainable. The eccentric feed mechanism permits the operator to set sliding dogs on the side of the table to automatically increase the depth of the grinding cut at each end of the table stroke. A graduated dial permits duplicate sizing of holes to be obtained quickly.

The main spindle and main table are lubricated with a force-feed oil system, and all revolving shafts are mounted in ball bearings. The machine illustrated is known as the model HG. The model KG is a still larger machine, with a capacity for grinding holes up to 48 inches in diameter by 84 inches deep.

The same company has brought out a locomotive valve gear link grinding attachment applicable to either the model DG or FG Micro internal grinders. A 1/2-horsepower motor making 1750 revolutions per minute is an integral part of the attachment. Links with radii having a range of from 20 to 100 inches can be ground. A scale is provided for quickly setting to the required radius. Brackets are furnished for holding the link in position for grinding, and a diamond for dressing the wheel is conveniently located.

The work-mounting platen has three T-slots in it and a center hole for mounting the links and blocks. A fine vertical adjustment for feeding the wheel to the work is provided. The horizontal slide ways of the fixture are 10 inches wide by 36 1/2 inches long. The total cross-travel is 30 inches. A heavy-duty ball-bearing spindle, holding a wide-face wheel, is supplied with the fixture. Facilities for applying water to the grinding wheel are included. The net weight of the fixture, spindle, and accessories is approximately 1300 pounds.

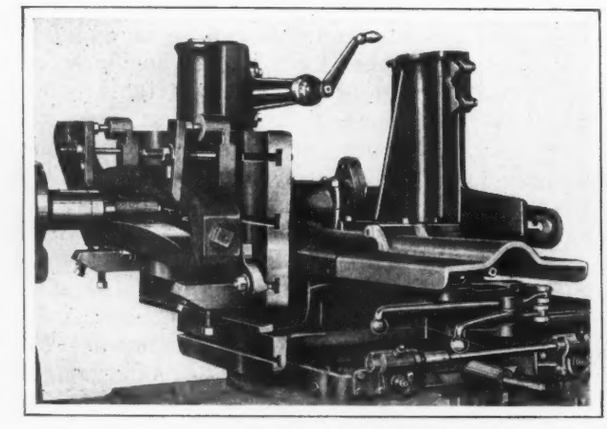
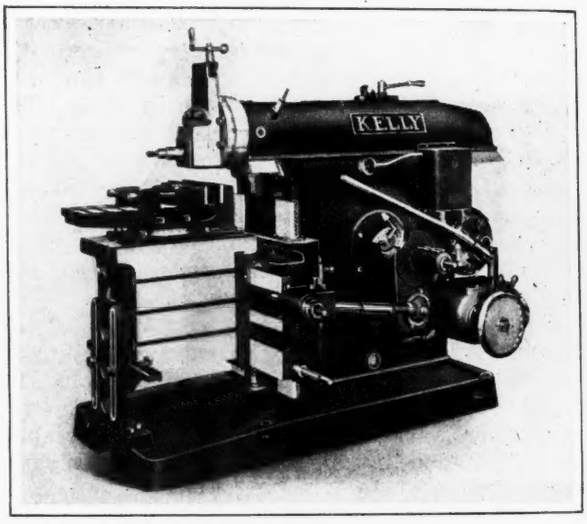


Fig. 2. Micro Locomotive Valve-gear Link Grinding Attachment

KELLY HEAVY-DUTY CRANK SHAPERS

A new line of shapers has recently been brought out by the R. A. Kelly Co., Xenia, Ohio. The NT type is furnished in 24-, 26- and 28-inch sizes, and the NTR type, in 32- and 36-inch sizes. The actual stroke of each machine is 1/2 inch greater than its designated size. The horizontal table travel of the NT type machines is 28 inches, and that of the NTR type, 30 inches. The vertical table travel of the NT machines is 15 inches, and that of the NTR machines, 13 inches.



Kelly Heavy-duty Shaper

Fifteen cross-feeds ranging from 0.010 to 0.150 inch per stroke are provided. Eight ram speeds which give a range of from 6 to 100 strokes per minute are furnished for the NT machines, while the larger machines have a range of from 6 to 90 strokes per minute.

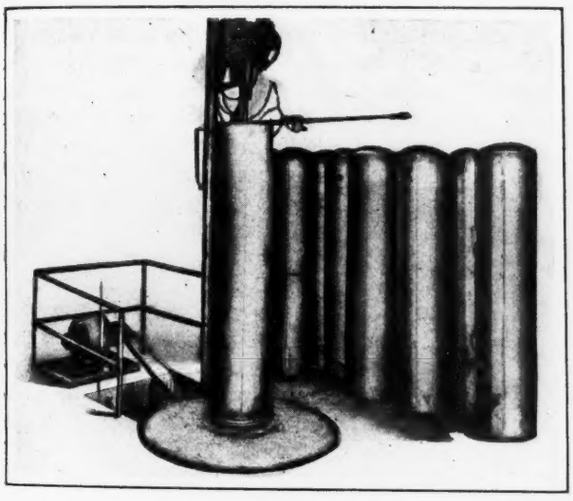
The main feature of the column construction is the V-type method of holding the cross-rail, the pull of the tool being taken by the solid metal vees. The toolpost can be swiveled to any angle, and is graduated 60 degrees each side of the zero position. The graduated collar on the "Mac-it" toolpost screw reads to 0.001 inch.

The gear-box is bolted directly to the side of the column, and has a press fit on the hub. The bearings are of the ball or roller type throughout. An index on top of the box indicates the speed of the ram. The main shaft drive is obtained through a friction clutch, and a disk type brake is provided for quick stopping. The motor is of the constant-speed type, and runs at a speed of 1750 revolutions per minute. The oiling system is entirely automatic; the only attention it requires is that the reservoir be filled about every sixty days.

The cross-feed is actuated by a single-disk cam which gives a smooth even motion. The feeding action takes place only on the return stroke of the ram, thus making it impossible to feed the table when the ram is moving forward. A direct-reading dial indicates the amount of feed. A safety device prevents breakage should the apron be allowed to feed against the ends of the cross-rail. A single pulley drive can also be supplied.

LINCOLN TANK WELDER

The accompanying illustration shows a carbon-arc automatic welding machine placed on the market by the Lincoln Electric Co., Cleveland, Ohio, for welding the bottom seams on cylindrical tanks. The illustration shows the machine applied in the welding of boilers for ranges. Standard equipment will weld tanks up to 6 feet in diameter and 8 feet high. Special equipment may be furnished to handle any diameter or



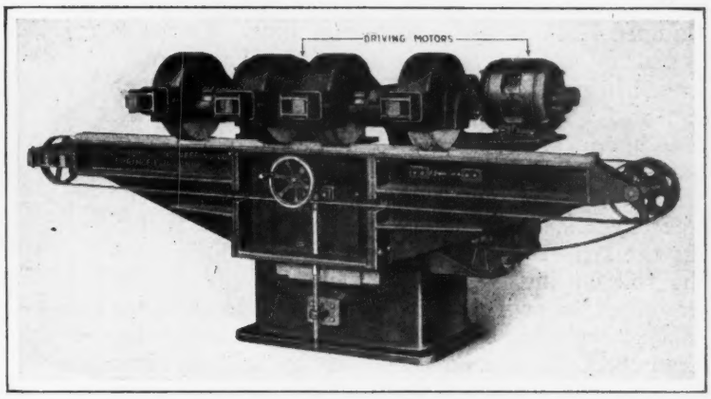
Lincoln Automatic Welder for Cylindrical Tanks

length of tank. On 14-gage material, a lap head seam may be welded at the rate of 135 feet per hour. The edge weld on the bottom of some types of range boilers may be welded at the rate of 150 feet per hour.

The tanks are set on a revolving table, and the arm carrying the automatic welding head is adjusted to bring the arc on the seam. The speed of the revolving table is adjustable over a wide range, as is also the welding current. The operator has an automatic stop and starting control on the automatic welder head.

MITCHELL AUTOMATIC BUFFING MACHINE

An automatic buffing machine suitable for buffing strips up to 3 inches wide has been brought out by the Mitchell Engineering Co., Springfield, Ohio. The strips to be buffed are laid on a conveyor belt at the left-hand end of the machine, and are carried by the belt past the wheels and discharged at the right-hand end. The rate of feed depends on the kind of work to be buffed, and can be altered by simply changing the sprockets on the conveyor drive.



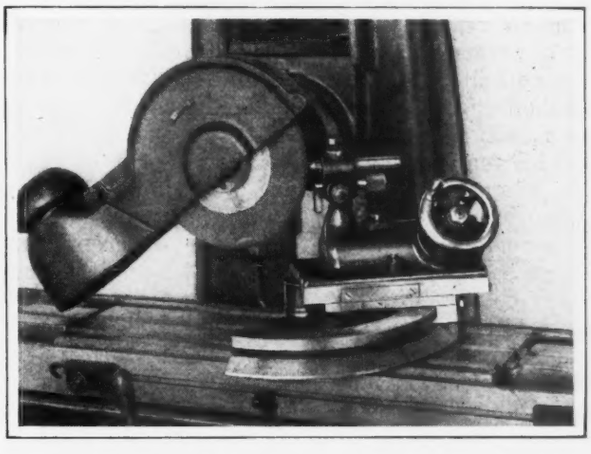
Mitchell Automatic Strip Buffing Machine

The machine has four buffing wheels, each two wheels being driven by a 10-horsepower motor controlled by magnetic switches and push-buttons. The wheels of each pair rotate in opposite directions, the method of buffing being for one pair of wheels to engage the strip approximately from the center to one outer edge, and the other pair to engage from the center to the other outer edge.

Means are provided for raising or lowering the conveyor table to give proper contact between the wheels and the work. Each pair of wheels with its driving motor, constitutes a separate unit adjustably mounted on the base of the machine to permit moving it in or out according to the width of the strips to be buffed. The machine complete weighs 6000 pounds.

BROWN & SHARPE WHEEL-TRUING ATTACHMENT

A radius and angular wheel-truing attachment has been designed by the Brown & Sharpe Mfg. Co., Providence, R. I., for use on the No. 2 surface grinding machines built by this concern. With this attachment, both convex and concave outlines having radii varying from 0 to 1 inch and with face angles up to 90 degrees either side of zero, can be formed. Also, numerous combinations of radial and angular shapes can easily be developed. The device is particularly desirable for use in grinding such work as lamination dies, flat forming tools, and miscellaneous pieces of circular or angular form.



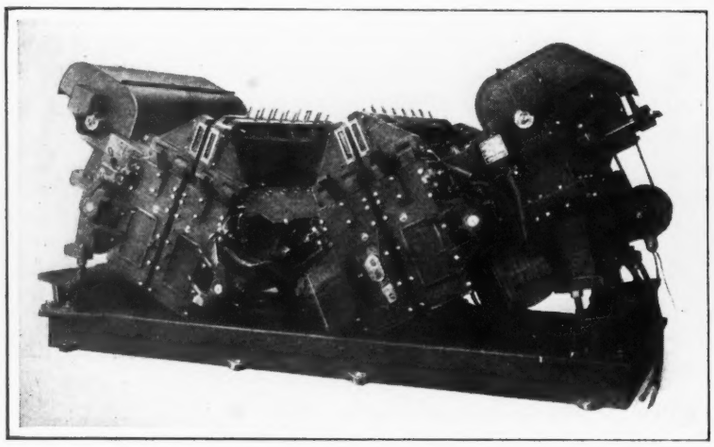
Brown & Sharpe Abrasive-wheel Truing Attachment

The attachment uses a diamond tool which is clamped in an upright post on a slide. The slide is graduated to permit fine adjustment, and can be locked in position. It is carried in a swivel which can also be clamped in any desired position, the base upon which the swivel is mounted being graduated to 90 degrees either side of zero.

Convex and concave shapes are obtained by clamping the slide at the desired radius and swinging the swivel through an arc sufficient to develop the full outline. Angular faces are obtained by clamping the swivel at the desired angle and then passing the slide back and forth by revolving the handwheel, the diamond tool being held at right angles to the slide. A raising block, to which the attachment is bolted when a magnetic chuck is employed, can be furnished. The weight of the attachment is 26 pounds.

TAYLOR-WINFIELD WELDING MACHINE

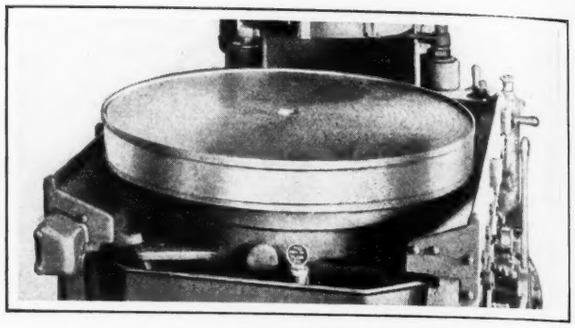
A very large welding machine, weighing approximately 20 tons, which occupies a floor space of about 13 1/2 by 7 feet and has an over-all height of 6 feet, has been built by the Taylor-Winfield Corporation, Warren, Ohio, for welding the backs and the two side panels of automobile bodies. The back is clamped in the center of the machine by



Taylor-Winfield Welder for Automobile Bodies

means of an air-operated toggle, and each side panel is clamped at the right- and left-hand side in the same manner. Each set of outside heads is worked independently by auxiliary switches operated by remote control switches, so that one side is first started and as soon as the weld is completed, the opposite side is started and completed. After unclamping, the entire back of the car is lifted out as a unit.

This machine has a capacity for steel sheets of No. 18 gage, 3 feet wide and 6 feet long. Both the upper and the lower dies in all the clamping heads are removable, so that dies for different body shapes can be accommodated. The angle adjustment possible for this purpose is from 15 to 35 degrees from the horizontal. The upsetting mechanism is automatic, and power is provided by two three-horsepower motors. The welding centers are adjustable from 34 to 50 inches, according to the setting of the machine. There are two 200-kilowatt transformers with water-cooled secondaries.



Blanchard 36-inch Magnetic Chuck

BLANCHARD 36-INCH MAGNETIC CHUCK

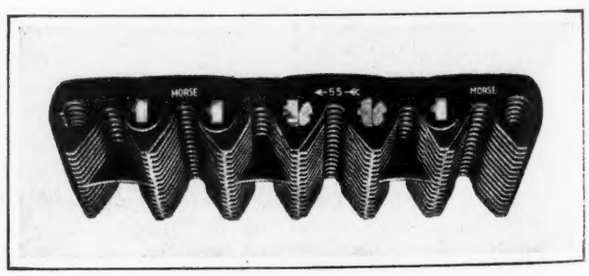
An over-size magnetic chuck, 36 inches in diameter, has been designed by the Blanchard Machine Co., 64 State St., Cambridge, Mass., for its No. 16 high-power surface grinder. This complete magnetic chuck is built into the machine in place of the standard 26-inch chuck, and is not removable. This chuck reduces the vertical range of belt-driven machines to 8 inches, and of direct motor-driven machines, to 10 inches. Its 36-inch diameter face is of the fine-divided type, similar to the standard chuck, and is magnetic to the extreme edge. Tapped holes are provided for securing centering stops. The water-tight one-piece steel construction of all Blanchard chucks is employed.

This chuck is recommended for use in grinding rings up to 36 inches in diameter, for pieces too long or irregular in shape to be well arranged on the 26-inch or 30-inch chucks, and for mill plates up to 36 inches. It is also suitable for small pieces, but if these present any considerable area, a large open space should be left in the center of the chuck to avoid excessive wheel area contact.

Guards of various heights can be furnished to suit requirements. By using special guards of large size and a column of extra height with this chuck, the capacity of the No. 16 grinder can be increased so that it will handle large work, such as two cylinder blocks 30 3/8 by 14 1/2 by 14 5/8 inches, at one time.

MORSE ROCKER-JOINT CHAIN

An improved type 55 rocker-joint sprocket chain has recently been brought out by the Morse Chain Co., Ithaca, N. Y. The improvements are principally in the design of the rocker joint, which operates on the same principle as the original Morse rocker joint. The seat pin has been enlarged to give

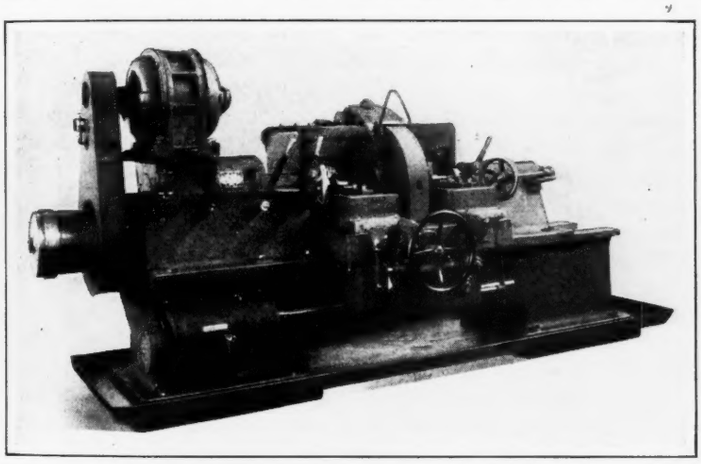


Morse Improved Rocker-joint Chain

greater bearing surface and also to make it a stronger transverse member to hold the chain together. The rocker pin has been changed in contour so as to make a better contact with the links. The combined joint members give a more nearly round hole with reduced clearance and hold the links more securely on the pins. The new joint is heavier and better balanced than the old one, and the breaking strength has been increased about 50 per cent.

WICKES CRANKSHAFT LATHE

A 34-inch semi-automatic center-drive crankshaft lathe constitutes the latest development of Wickes Bros., Saginaw, Mich. The crankshaft is held in this machine on anti-friction live centers, and is driven from the center bearing which has previously been machined, by means of a herringbone gear which securely clamps this bearing. The arrangement of the herringbone gear and the centers is such that the chucking of a crankshaft is easy and requires only one minute. In one operation, the lathe machines the front bearing, front end of the crankshaft, rear bearing, oil-grooves, and flanges. The drive is by a silent chain from a 15- or 20-horsepower motor on the headstock.



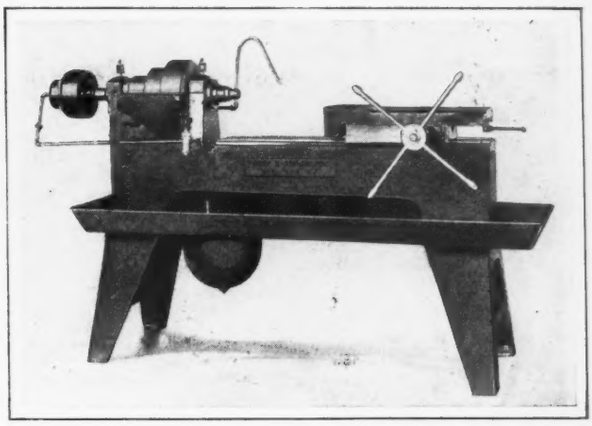
Wickes Semi-automatic Center-drive Crankshaft Lathe

The cross-slides are so arranged that the tooling can easily be changed for machining crankshafts of a varying number of bearings and throws. The lathe is equipped with a power feed, quick-change gear-box, automatic split-feed, automatic feed-stops, and an automatic accelerating device for the crankshaft that maintains a constant lineal cutting speed at the tool bits.

The rear tools are carried on inverted cross-slides, which permits easy clearance of the chips. The cross-slides are equipped with the Wickes patented electric cross-traverse for quickly advancing the tools to the cutting position and withdrawing them to the unloading position. The approximate weight of the machine is 17,500 pounds.

STEVENS AIR-OPERATED CHUCKING MACHINE

A No. 2 1/2 air-operated chucking machine has been placed on the market by John B. Stevens, Inc., 27 Cleveland Place, New York City. The head mechanism is designed so as to reduce the "idle time" in chucking work. A turn of the valve causes the spindle to stop instantly, and the chuck jaws open immediately afterward for the removal of the work. After inserting the next piece of work, a turn of the valve causes the chuck jaws to grip the work instantly and the spindle immediately begins to revolve. Thus several of the movements usually required in starting and stopping and in removing and replacing work are eliminated.



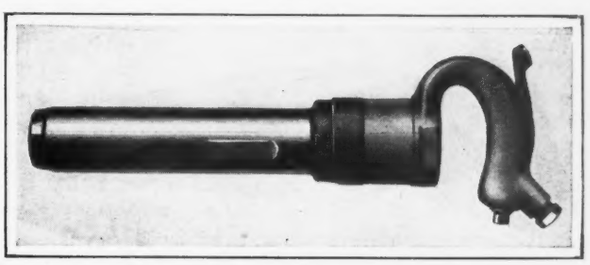
Stevens Air-operated Chucking Machine

The machine is provided with a plain slide, pan, pump, and piping. Wrenchless chucks, collets, and expanding mandrels of the draw-back type can be readily fitted to the front end of the spindle. The protruding tube is attached to the inner or moving members of chucks and collets. A regular six-hole turret with slide and base can be supplied in place of the plain slide and base, and the machine can be provided with either hand or power feed. It is driven by a belt 3 1/2 inches wide, from a double friction countershaft. The air pressure required for operating the chucking mechanism ranges from 65 to 100 pounds per square inch, only a very small volume of air being exhausted at the operation of the valve.

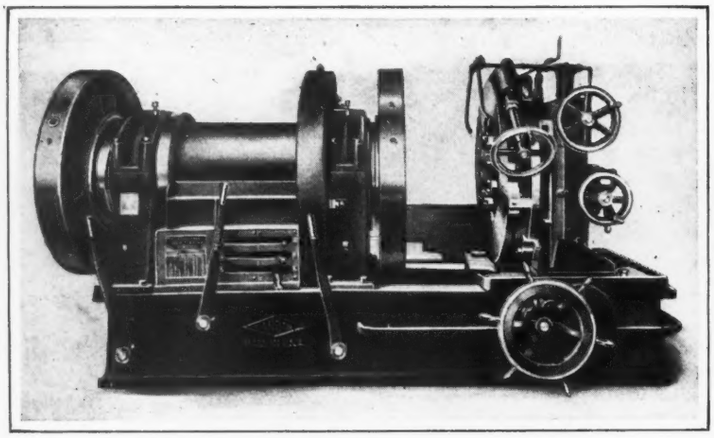
"CLECO" RIVETING HAMMER

A new "Cleco" riveting hammer is the latest product of the Cleveland Pneumatic Tool Co., Cleveland, Ohio. This tool is short, light in weight, has solid walls free from port-holes, and is reinforced against injury from piston slap.

The chief feature of this riveter is the main valve, which is so constructed as to provide a



"Cleco" Riveting Hammer



Landis 16-inch Pipe-threading and Cutting Machine

steady and precise action of the hammer. The piston is actuated by live air in both directions. Between the outer walls of the valve block and the inner bore of the handle is a "power pocket" in which air is stored up and discharged on the piston at the beginning of each stroke, giving added impulse to the piston and increasing the speed and force of the blow. A cushion chamber in the rear end of the valve block insures a constant cushion for the piston on its return stroke.

The balanced throttle valve is operated by a throttle lever so controlled that it allows a reasonably free action before engaging the valve. The valve action regulates and graduates the air supply. The safety handle lock is of new design and so constructed that easy and close adjustments may be made when the hammer becomes worn in service.

LANDIS PIPE-THREADING AND CUTTING MACHINE

A 16-inch pipe-threading and cutting-off machine has recently been added to the line of the Landis Machine Co., Inc., Waynesboro, Pa. This machine has a range of from 8 to 16 inches, inclusive. One die-head and one set of chasers are employed for covering this range. The travel of the carriage is 25 inches.

The machine is provided with a gear-box and single-pulley drive, the pulley being 18 inches in diameter and taking an 8-inch belt. The gear-box is located beneath the main spindle and provides eight speeds. The shaft bearings are lubricated by a forced-feed system, and the main bearings by flat link chains running in oil reservoirs. The gears run in an oil bath.

A reverse drive, located in the gear-box, is used for putting on and taking off flanges. This reverse drive is controlled by the middle lever shown. The lever located near the front chuck is for starting and stopping the machine when threading, and the lever near the rear chuck is for starting and stopping the machine when doing flange work.

The front and rear gripping chucks are of the three-jaw type and have universal adjustment. The rear chuck is equipped with flange grips for screwing flanges and collars on and off. The cross-rail supports the die-head, and is fitted with centering jaws, cutting-off tool, and reaming tool at the rear. The reaming tool may be locked for the reaming operation and can also be employed for chamfering the ends of the pipe. The die lubricating system includes a rotary pump, a by-pass for surplus oil, and special control valves at the head and cutting-off tool.

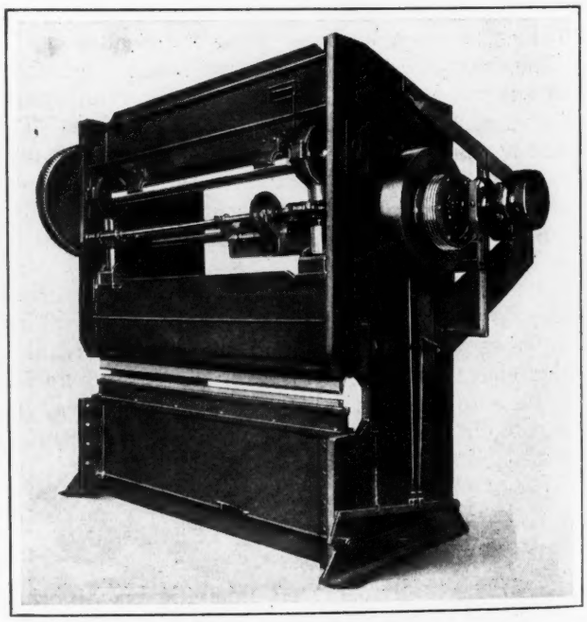
The machine is easily adapted for motor drive, and the motor can be applied after the machine is in service. It is mounted at the rear, on a plate over the gear-box; a silent chain transmits the power from the motor to the machine. A 20-horsepower constant-speed motor, wound for an approximate speed of 1200 revolutions per minute is required.

The floor space needed for this machine is 6 feet 2 inches by 11 feet 6 inches. It weighs, belt-driven, 16,900 pounds; motor-driven, 18,000 pounds.

DREIS & KRUMP FORMING PRESSES

A series of all-steel forming presses of the single housing type has recently been developed by the Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill. These presses have been designed for light work with special attention to convenience of operation. The housings, ram, and bed are made of steel plate, and the gears are made of steel. The eccentric strap, knuckle bearings, and gibs for slides are semi-steel castings. The forged-steel eccentrics are keyed to a high-carbon steel shaft.

The flywheel runs on Timken roller bearings. The clutch is of the multiple-disk type having asbestos friction blocks. It is engaged by a foot-treadle which may be set at any point along the full length of the machine. Release of the treadle operates a friction brake which instantly stops the ram. Adjustment of the ram is obtainable by an independent motor, controlled by a reversing switch. Force-feed sight oilers provide automatic



All-steel Forming Press Built by the Dreis & Krump Mfg. Co.

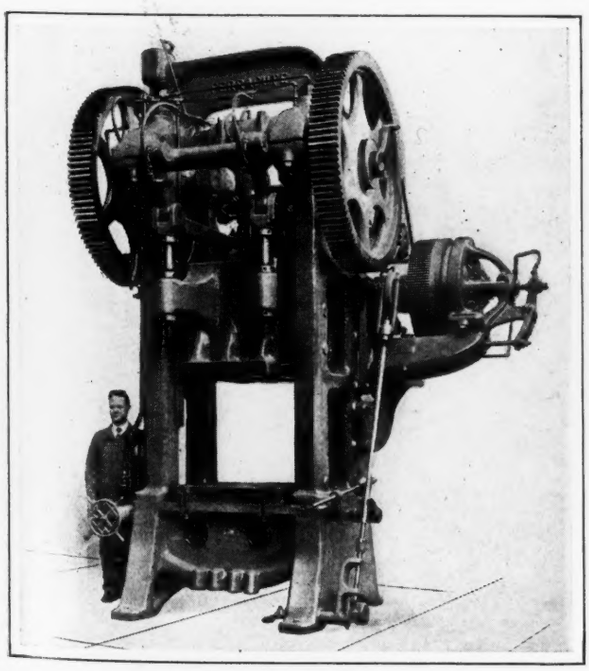
lubrication to the eccentrics, bearings, and slides. The presses are set level on the floor, requiring no foundation or pit, and are shipped set up in one piece. They are arranged for a direct motor drive to the flywheel.

FERRACUTE DOUBLE-ACTION DRAWING PRESSES

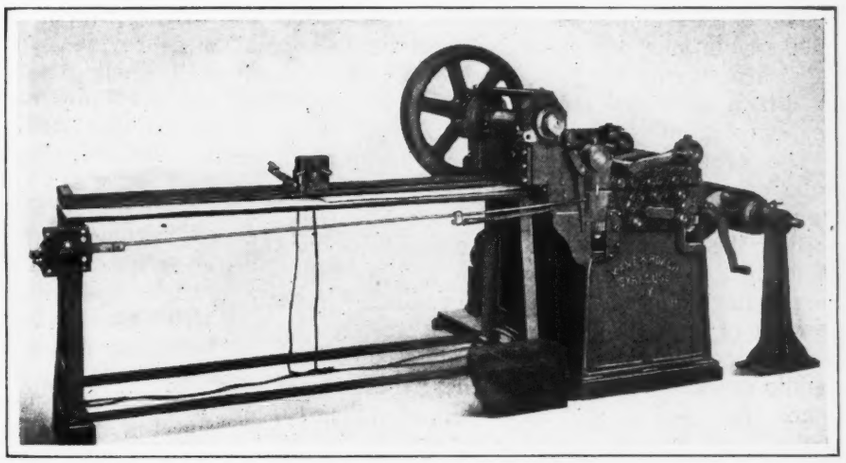
Several lines of double-action drawing presses of tie-rod construction have recently been developed by the Ferracute Machine Co., Bridgeton, N. J. The press shown in the illustration is capable of exerting pressures up to 150 tons. These new presses are made in a number of widths, all having the same columns, wheels, friction clutch, etc. The press shown has a width of 40 inches between the columns.

The ram is driven down by toggles actuated by a cam which is constructed to give a long dwell. The plunger, connected to the crank on the main shaft, forces the punch down and brings it back. Twin gears equalize the torsion. The press can be started or stopped at any part of the stroke.

The particular machine shown is equipped with force-feed lubrication from a single point. The stroke of the ram is 10 inches, and the stroke of the plunger, 20 inches. The height from the bed to the ram, at the top of the stroke and adjustment, is 36 inches, and the height to the plunger under the same conditions is 48 inches. A motor mounted at the rear and equipped with a rawhide pinion which meshes with teeth cut in the flywheel furnishes the drive. Steel tie-rods in the columns take the tensile stresses. The total weight of the press is about 51,850 pounds.



Ferracute Double-action Drawing Press



Kane & Roach Sheet Leveling Roll

KANE & ROACH SHEET LEVELING ROLLS

In the accompanying illustration is shown one of a new type of sheet leveling rolls recently placed on the market by Kane & Roach, Inc., Syracuse, N. Y. This machine is made in several sizes with rolls varying in number, diameter, and width to meet specified conditions. When required, the machine can be equipped with automatic cut-off shears and delivery or automatic dumping table. The machine shown is equipped with the automatic cut-off shear and delivery table. This machine is set up for handling, from coils, aluminum sheets 16 inches wide and from 0.004 to 0.006 inch thick. Material that has been cut to lengths can be handled as well as rolled stock.

The lower rolls, which are six in number, are stationary, while the six upper rolls are mounted in a unit head that is adjustable at both the feed and the delivery ends. The lower rolls are driven by gears, and the upper rolls by two steel roller chains. The machine will deliver stock at a speed of approximately 75 feet per minute.

The shear is of the standard flywheel type, designed to give a clean sharp cut. The shear shown will cut off material in lengths from 10 inches up, within plus or minus 1/32 inch. A Cutler-Hammer electric switch and solenoid automatically trip the cut-off shear. The sheet leveling rolls and the cut-off shear are driven by a five-horsepower motor.

GORTON UNIVERSAL DIE-SINKING AND ENGRAVING MACHINE

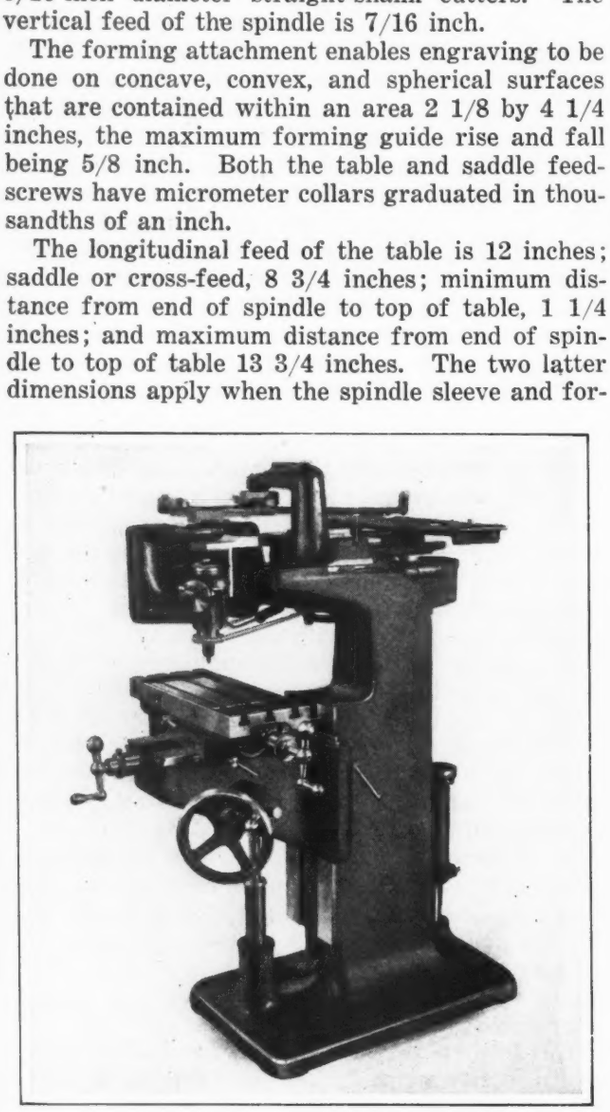
The new No. 3-X universal die-sinking and engraving machine recently brought out by the George Gorton Machine Co., Racine, Wis., is suited either for heavy or light engraving and die-sinking on flat or spherical surfaces. While specially adapted to heavy cutting on steel dies and stamps and similar work in brass and cast iron, it is sufficiently sensitive in operation to be satisfactorily employed for delicate lettering work, such as is ordinarily handled on the 1-A and 1-G machines made by this company. The machine is equipped with ball bearings throughout.

The pantograph bars are graduated for reductions of 3, 4, 6, 7, 8, 10, 12, 14, and 16 only, but reductions from 3 to 1 down to 0 to 0 are obtainable.

The cutter-spindle has speeds of from 2300 to 9000 revolutions per minute. Special collet bushings are furnished for 1/8-, 3/16-, 1/4-, and 5/16-inch diameter straight-shank cutters. The vertical feed of the spindle is 7/16 inch.

The forming attachment enables engraving to be done on concave, convex, and spherical surfaces that are contained within an area 2 1/8 by 4 1/4 inches, the maximum forming guide rise and fall being 5/8 inch. Both the table and saddle feed-screws have micrometer collars graduated in thousandths of an inch.

The longitudinal feed of the table is 12 inches; saddle or cross-feed, 8 3/4 inches; minimum distance from end of spindle to top of table, 1 1/4 inches; and maximum distance from end of spindle to top of table 13 3/4 inches. The two latter dimensions apply when the spindle sleeve and former yoke are in their extreme upper positions. The machine will handle a disk 5 inches thick by 36 inches in diameter or anything under this size. A drum 13 inches high and 26 inches in diameter or any smaller size can also be accommodated. The weight of the machine complete is approximately 1020 pounds.

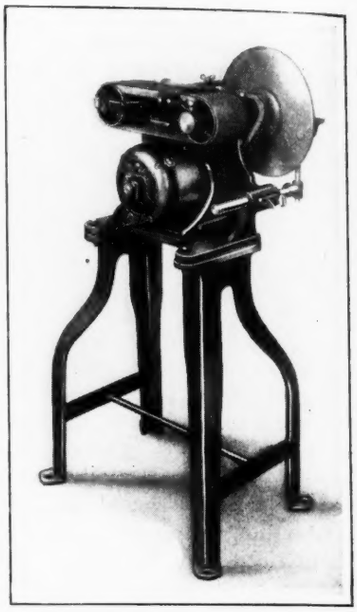


Gorton Universal Die-sinking and Engraving Machine

WALLS BAND AND DISK GRINDER

An improved motor-driven abrasive band and disk grinder, known as the "Duplex-M," has been placed on the market by the Walls Sales Corporation, 96 Warren St., New York City. This grinder has the regular quick-change band feature of other machines built by the same concern. The table over which the abrasive band operates is 10 1/4 inches long by 5 inches wide, and is planed true to produce level surfaces on the work. An abrasive band 4 inches wide is used, and may be brought to any fixed position by adjusting two thumbscrews.

The grinder is also provided with a 12-inch removable steel disk and a grinding table for the disk, which may be raised, lowered, or turned to various angles as required. The grinder is operated by a 1/2-horsepower motor connected by a silent chain. The speed of the motor is 1750 revolutions per minute. The machine occupies a floor space of 20 by 24 inches, and weighs 225 pounds.

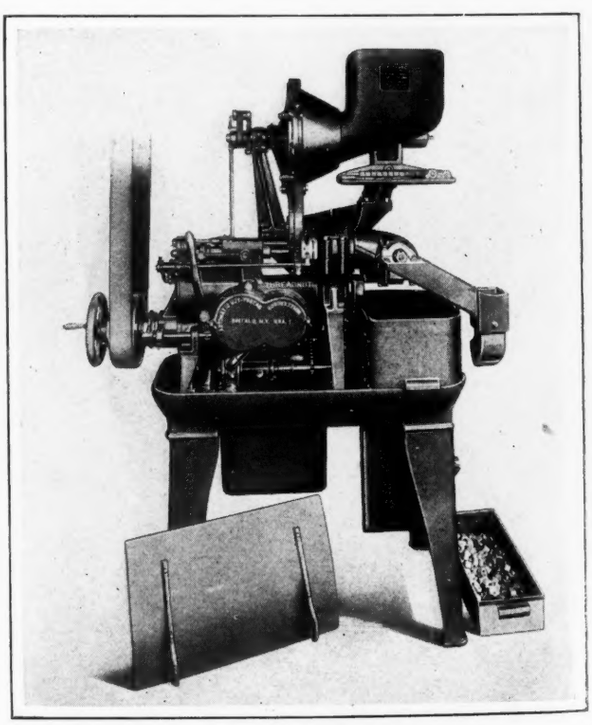


Walls Duplex Abrasive Band and Disk Grinder

With this machine, grinding can be done on the disk, and finishing on the abrasive band, on metal, composition materials, or wood. The finish obtained varies according to the grit of the abrasive band and disk used.

AUTOMATIC NUT-THREADING MACHINE

An automatic nut-threading machine of the continuous tapping type, using a bent shank tap, has just been placed on the market by the Automatic Nut-Thread Corporation, 24 W. Tupper St., Buffalo, N. Y. This machine, which has been designated the "Threadnut" No. 2, has a capacity for tapping hexagon or square hot-pressed, cold-punched, or brass nuts, from 9/16 inch U. S. stan-



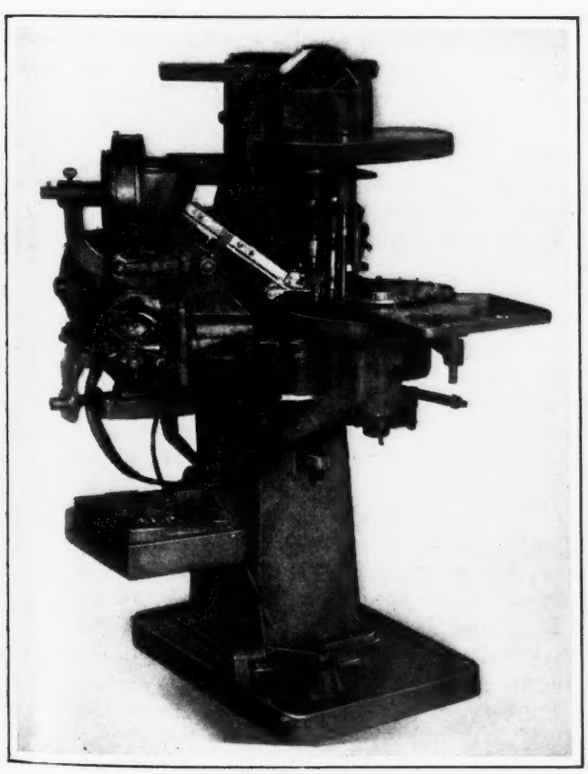
Automatic Machine for Threading Nuts

dard to 7/8 inch S. A. E. standard. The recommended production speed is 15 U. S. standard nuts and 10 S. A. E. nuts per minute. On test, the machine has tapped eighteen 3/4-inch U. S. standard nuts per minute. A change of set-up from one size of nut to another is made in from fifteen to thirty minutes. The machine is fully automatic with a rotary drum-type hopper feed.

The machine accommodates standard high-speed steel, bent-shank taps, and because of the method of holding the taps, their temper may be much higher than usual. The machine is equipped with ball bearings throughout, and all bearings and gears are enclosed and run in oil. The drive is through a single clutch pulley. An automatic safety clutch throw-out stops the machine in case the feeding mechanism becomes clogged, thus eliminating any possible chance of tap or machine breakage. A special feature is a new type of register device for presenting the nuts to the tapping jaws.

ANDERSON DIAL-FEED TAPPING MACHINE

In the manufacture of electrical wiring devices, it is necessary to insert binding screws for connecting wires. These screws are riveted over or staked on the end after being inserted, in order to prevent them from being entirely backed out and accidentally dropped when the electrician makes connections. For tapping such parts, inserting the screws, and staking the screws—all in one operation—the Anderson Die Machine Co., Bridgeport, Conn., has developed equipment which is applied to the dial-feed tapping machine built by the company. This equipment is shown on the machine illustrated. It consists of a hopper for feeding the screws automatically, a screwdriver for driving the screws to the desired tension, and an automatic staking tool which gives a uniform blow on the end of the screws, regardless of variations in length.



Anderson Dial-feed Machine Arranged for Tapping and for Inserting and Staking Screws

One, two, or three holes can be tapped at a time, either in the same or in different planes, and the screws inserted and staked, at a production of from 40 to 45 complete pieces per minute. By simply adjusting the chute rails, the hopper can be made to feed screws from No. 3 to No. 10. The hopper is operated directly from the machine, so that a separate source of power is not required. The screwdriver has a friction clutch device through which the torque exerted can be adjusted to suit requirements. This device also eliminates burring of the screw-head slots. The work is automatically ejected when finished. A dial is furnished as a complete unit for any work to be tapped, and so the machine is not of the single-purpose class.

FAY & EGAN STATIC BALANCING MACHINE

A No. 661 portable ball-bearing static balancing machine which can be set up in any place and requires no leveling has recently been placed on the market by the J. A. Fay & Egan Co., Oakley, Cincinnati, Ohio. Parts such as pulleys, flywheels, fans, cutter-heads for woodworking machines, up to 100 pounds in weight, can be accurately balanced. Balancing to 1/8 ounce-inch is possible on this machine. The revolving plates are hardened and ground, and turn on ball bearings. The balance stands are adjustable for any length, and are regularly furnished for a maximum setting of 24 inches between plates.

Balancing Machine for Pulleys, Flywheels, etc.

* * *

HEALD ACQUIRES GIDDINGS & LEWIS GRINDING INTERESTS

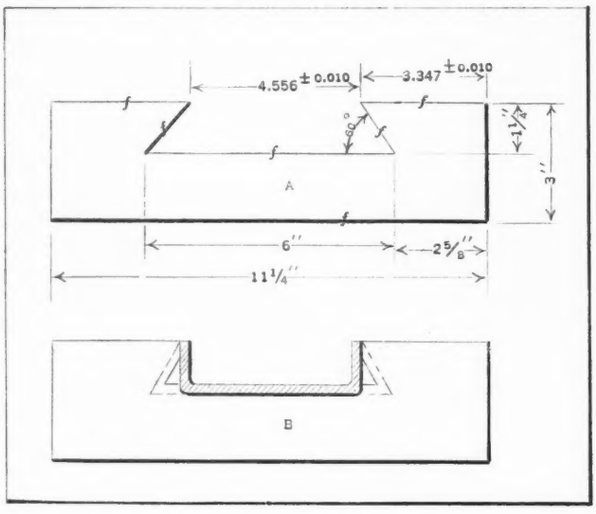
The Heald Machine Co., Worcester, Mass., has acquired the grinding machine interests of the Giddings & Lewis Machine Tool Co. of Fond du Lac, Wis. The purchase included all the assets of the Grinding Machine Division of the Giddings & Lewis Machine Tool Co., including drawings, patterns, jigs, tools and fixtures, inventory of machines and parts, patent rights and good will. The Giddings & Lewis Machine Tool Co. will now be in a position to devote its entire efforts to the manufacture and development of precision horizontal boring, drilling, and milling machines.

WORKING DIMENSIONS ON DRAWINGS

By CHARLES J. WESTIN

I read with interest the article entitled "Working Dimensions on Drawings," on page 692 of May MACHINERY, and believe that a few comments will be of value. Referring to the dovetail part shown in Fig. 1 (page 692), the explanation given for the method of dimensioning does not quite agree with my experience on similar problems. The author of the article states that the machinist is not satisfied with the dimensions given. I believe the machinist has just grievance. The drawing is made to serve him, and should be dimensioned so as to enable him to produce the part economically and efficiently.

Is it possible to measure the distance given as 6 inches between the sharp corners? Would it not require a special templet or gage unless the dovetail vernier calipers, just placed on the market by the L. S. Starrett Co. were available? Of course,



Method of Dimensioning Dovetail

the machinist may make a lay-out on one end and work to the lines, provided the ends are finished, but if neither end is finished, that scheme is useless, except as a guide for the roughing cuts.

If the shop is equipped with the proper angular cutter, the job should be done as illustrated and described on page 134 of MACHINERY'S book "Planing and Milling," under the heading "Milling a Dovetail Groove." By using this method, the finished dimension of 6 inches can be obtained without any difficulty, making use of the graduations on the feed-screws; but in roughing out the channel (see *B* in the accompanying illustration) whether done in the shaper, planer, or milling machine, the dimensions at the top of the dovetail in the diagram at *A* would be required.

The author of the previous article states that the dimension at the top was intentionally omitted, because the calculated dimension happens to be an odd decimal, and, if given on the drawing, would indicate too great accuracy, as the fractional dimension tolerances of plus or minus 0.010 would no longer apply. Why not show the tolerance after the dimension (4.556 ± 0.010)? Most up-to-date concerns use some system of this kind. What difference would it make in the resulting dovetail, if the nearest fraction which is 4 9/16, or in decimals 4.562, was used? This fraction is 0.006 larger than the basic dimension, as calculated, and supposing the full plus tolerance in machining to the 4 9/16 dimension were taken, it would only make the dovetail 0.006 larger than originally desired, which would not be noticeable on this kind of work, particularly if a gib were used for the final fitting.

Now, referring to the jig shown in Fig. 2 of the previous article, is the material for this jig finished in another department according to a special drawing before it is given to the toolmaker for machining the holes? If not, how can the toolmaker finish the blank without having the over-all length given? We must assume that the drawing was not carefully checked, and send the blueprint back to the drafting-room to be completed.

It is understood that the diagonal dimensions between the holes were intentionally omitted, and are to be supplied by the jig designer. When the jig is finished and given to a drill press operator, he does not care about any center distances. He works according to the jig—perhaps never sees the drawing of the piece; but I fail to see how any department can be interested in having the diagonal dimensions omitted or could find it objectionable if they were given.

Another side of this problem is the question of whether the toolmaker would bother using buttons for a job having tolerances of plus or minus 0.010. He would be wasting time in doing the work to greater accuracy than required. However, whatever method is used in machining the holes, the diagonal dimensions would be useful. Even the patternmaker would find them of advantage, if he were required to place bosses for each of the holes shown.

For many years, as draftsman, chief draftsman, and designer, I have followed a certain set of rules and found that the results have satisfied the most exacting shop men. There is nothing new about these rules, but it will not do any harm to repeat them. I call them "A Detailer's Ten Commandments":

1. Make details to a scale large enough to show all parts and dimensions distinctly.
2. Use enough views and sections to show the part clearly.
3. Give all necessary dimensions, so that the workman never will have occasion to scale the drawing, do any figuring, or refer to handbooks.
4. Place dimensions in a systematic and orderly manner.
5. Points having a specific relation to each other should be directly tied together by a dimension.
6. Keep dimensions off the body of the piece when it can be done conveniently.
7. Do not repeat dimensions on the same or on different views, unless for a special reason.
8. Place the parts on the drawing as nearly as possible in the same relative position that they have in the machine.
9. Do not be afraid to put notes on the drawing, if they will help the man in the shop.
10. Make the drawings to meet the standard practice of the departments concerned and the equipment available.

UNUSUAL INCREASE IN DRILLING PRODUCTION

It is not unusual for production to be increased by 50, 75, or even 100 per cent by the installation of new equipment, but it is not very often that a production seven times that formerly obtained can be recorded. Recently, however, our attention was called to a case of this kind at the plant of the Anchor Post Fence Co., Garwood, N. J., where in the drilling and tapping of holes in galvanized machine steel gate and fence posts, the installation of new equipment resulted in increasing production seven times, as compared with the results formerly obtained. The accompanying illustration shows

Drilling Gate and Fence Posts at a Rapid Rate

the equipment now being used, consisting of a Moline straight-line fifteen-spindle drilling and tapping machine equipped with Jarvis drill chucks and tapping attachments. The largest hole drilled is 5/16 inch in diameter, the largest taps used being 3/8 inch in diameter. A three-spindle drilling machine was formerly used for this work.

* * *

A new record for high-pressure steam turbines will be set by the unit which is to be installed by the Boston Edison Co. in its Edgar plant. This company, the first to operate a turbine under a steam pressure of 1200 pounds, will now add a second unit operating at the same pressure. The original unit, a 3000-kilowatt, 3600-R.P.M., 20-stage turbine generator, was installed in 1925. The additional machine will be of 10,000 kilowatts capacity at 3600 R.P.M. One other unit has been built for operation at 1200 pounds pressure; this is a 7000-kilowatt turbine generator in service in the Milwaukee Electric Railway & Light Co. station. These high-pressure units are of General Electric manufacture. We are informed that, with the exception of these three turbines operating at 1200 pounds pressure, the maximum operating pressure in American central stations is 600 pounds.

REDUCING THE NUMBER OF BALL BEARING SIZES

To encourage the use of fewer sizes of radial ball bearings, the standards department of the Society of Automotive Engineers (29 W. 39th St., New York City) about a year ago listed the sizes that were most extensively used by motor vehicle manufacturers. Since then, several bearings manufacturers have printed the reduced list in their catalogues, and at a recent meeting of representatives of the manufacturers, it was agreed that it would be helpful to republish the list and bring it to the attention of the automotive industry in general. This has been done in the current issue of the S.A.E. Handbook. By consulting this list, the users of ball bearings are enabled to select bearings of sizes in regular quantity production and thus gain the advantage of quick deliveries from stock and, eventually, reduced costs, which the bearing manufacturers may be able to make as a result of a reduced demand for special sizes and an increased demand for the regular listed sizes.

* * *

STATISTICS OF THE AUTOMOTIVE INDUSTRY

In a statement published by L. P. Ayres of the Cleveland Trust Co., Cleveland, Ohio, it is mentioned that the automotive industry has definitely entered upon a new stage of its development: More than half of the new cars sold in this country annually are now required to replace the old ones scrapped during the year, and considerably less than half go to increase the total number in use. In a real sense this marks the transition of the industry from youth to maturity.

The accompanying table shows the approximate number of new passenger cars sold in the United States annually during the last twelve years, the registration, the number scrapped, those in use at the end of the year, and the net increase.

The registration figures are almost always cited as representing the number of automobiles in use,

Statistics of Automobile Sales and Registration

Year	New Cars Sold	Registration	Scrapped in Year	In Use at End of Year	Gain in Year
1915	747,000	2,273,000	139,000	2,134,000	608,000
1916	1,373,000	3,507,000	155,000	3,352,000	1,218,000
1917	1,591,000	4,943,000	176,000	4,767,000	1,415,000
1918	815,000	5,582,000	243,000	5,339,000	572,000
1919	1,520,000	6,859,000	317,000	6,542,000	1,203,000
1920	1,653,000	8,195,000	416,000	7,779,000	1,237,000
1921	1,446,000	9,225,000	572,000	8,653,000	874,000
1922	2,230,000	10,883,000	766,000	10,117,000	1,464,000
1923	3,446,000	13,563,000	1,120,000	12,443,000	2,326,000
1924	2,994,000	15,437,000	1,419,000	14,018,000	1,575,000
1925	3,435,000	17,453,000	1,755,000	15,698,000	1,680,000
1926	3,526,000	19,224,000	2,130,000	17,094,000	1,396,000

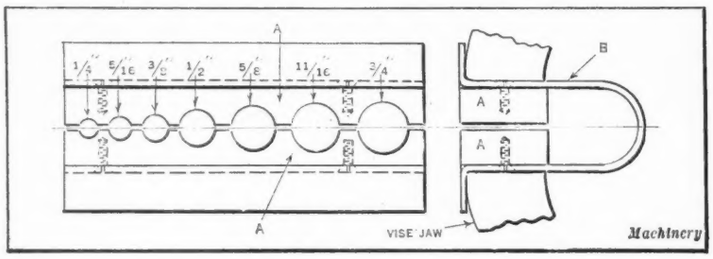
Machinery

but of course this is not so, for each car that drops out of use during a year is also included in the registration of that year and must be deducted in counting up the cars actually in use. The net increase in the number of cars in use rose irregularly to 1923, with sharp decreases in the war year of 1918 and the depression year of 1921, and has declined since 1923. The number of cars scrapped annually has steadily increased until now it is about 60 per cent of the number of new cars sold.

Shop and Drafting-room Kinks

AUXILIARY VISE JAWS FOR HOLDING ROUND WORK

Small round or cylindrical pieces are frequently mutilated by the vise jaws if clamped with sufficient pressure to prevent slipping. One of the most convenient methods of handling round pieces, such as screws that are to be slotted, thin metal tubing, drill stock or dowel-pins, is by means of a special clamp like the one shown in the accompanying illustration, which was devised by a workman in the tool-room.



Auxiliary Vise Jaws for Holding Round Work

This clamp consists of a pair of vise jaws *A*, with openings graduated in size from 1/4 to 3/4 inch, which are held in place by a spring sheet-metal back *B* terminating in shoulders that serve to support the clamp in position between the jaws. The special clamp jaws *A* are made from a piece of soft boiler plate, which is drilled out, and then slotted or sawed across. The sheet-steel back *B* is secured to the pieces *A* by machine screws, as shown.

Washington, D. C. G. A. LUERS

DOWEL-PIN HOLES IN HARDENED DIES

A kink that the writer has used for some time in obtaining tight-fitting dowel-pin holes in dies may be of interest to diemakers. If dowel-pin holes are made in the die and the die is hardened, the holes, in some cases, will change their shape to such an extent that they will be a poor fit for the dowel-pins. In order to overcome this trouble, the writer drills holes in the die before hardening which are considerably larger than the dowel-pins to be used. After the die is hardened, soft steel plugs are fitted into the holes and the dowel-pin holes drilled and finished in the soft plugs.

Philadelphia, Pa. CHARLES KUGLER

METHOD OF SETTING COMPOUND REST

In my several years of experience, both as a toolmaker and as a teacher of machine shop practice, I have found that most beginners, as well as many experienced mechanics, have considerable trouble in setting the compound rest of a lathe or the tool-head of a shaper or planer to a given angle. The following rules, which I have worked out to simplify this problem, will prove an unfailing guide:

1. First find the line from which the angle is given.
2. Set the compound rest or tool-head parallel with this line.
3. Move the rest or tool-head from this position through the required number of degrees, as given on the drawing, and proceed to machine the work.

Do not pay any attention to the location of the zero point on the scale, and disregard the direction of the numbering, except as it may assist in counting the degrees.

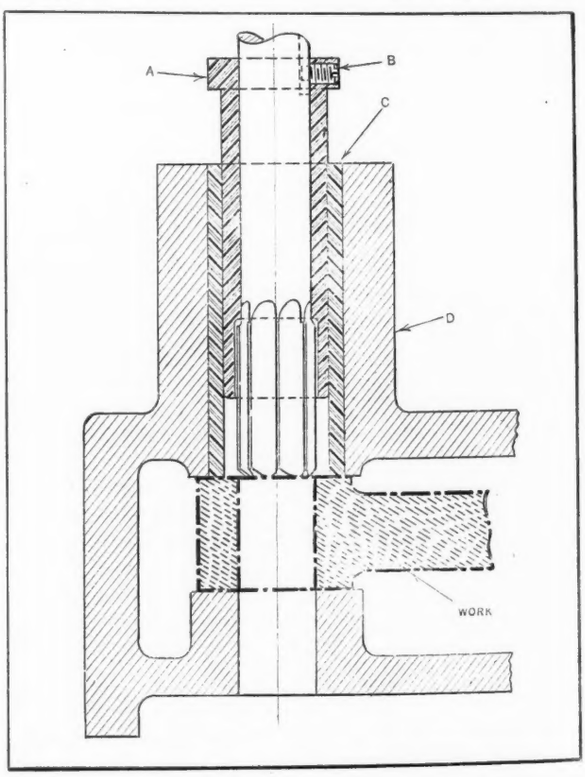
If these rules are memorized and followed consistently, the practice will quickly become fixed and the danger of making errors greatly lessened.

Terre Haute, Ind. A. H. LUEHRING

REAMER BUSHING DESIGNED TO MAINTAIN ACCURACY

A reamer guide bushing designed to prevent the blades of the reamer from coming in contact with the hardened bushing is shown in the illustration. The bushing *A* is a close sliding fit on the reamer shank and revolves with the shank, the dog-point set-screw *B* serving to drive the bushing and at the same time permit the reamer to have an independent vertical movement. The bushing *A*, of course, revolves in the liner bushing *C*, which is pressed into the body *D* of the jig.

Buffalo, N. Y. C. W. PUTNAM



Reamer Bushing for Production Work

Notes and Comment on Engineering Topics

The raw materials of the electrical industry probably come from more varied sources than those of any other industry. Almost every part of the world supplies some of the materials used in electrical machinery. Sheet mica, so important for insulation purposes, for example, comes mainly from India, where from 65 to 70 per cent of the world's supply is found.

About 1850, when the only power used at a blast furnace was for blowing and all other work was performed by hand labor, furnaces had a production of perhaps 25 to 50 tons per day. Today, with only a fraction of the number of men previously employed per furnace, from 700 to 800 tons of pig iron are produced at a much lower cost, although wages have probably quadrupled.

The German Railways Co., which includes all the railways of Germany and which, organized under the direction of the Dawes Commission, took over all the state-owned lines, comprises 30,000 miles of track and employs over 700,000 men. In point of traffic carried, it is claimed to be the largest railroad system in the world. One billion eight hundred million passengers are carried annually.

We have been recognizing for years, that any business, to succeed, must furnish service, but now we have come to realize that there are two forms of service—the direct and tangible things we do for our own customers in order to get immediate profits, and the service one industry renders to all others by doing its share to maintain American standards.—*E. G. Grace,* President, Bethlehem Steel Co.

An invitation to visit the next World Motor Transport Congress, to be held in London, November 14 to 16, and the International Motor Transport Exhibition in London from November 17 to 26, has been extended to members of the Society of Automotive Engineers in this country by the Society of Motor Manufacturers and Traders of Great Britain and the Institution of Automobile Engineers of England.

The use of welding in the construction of factory and other plant buildings is to be adopted by the General Electric Co. in future building programs, it has been announced by that company. The reason given for the adoption of this policy is that the welded structure can be made with less material than the riveted structure for the same loads. The General Electric Co. feels that its experience with welding indicates that as soon as adequate shop methods are developed, it will be possible to fabricate buildings by the use of welded joints cheaper than they can be fabricated by the use of riveted joints. Those in charge of the building plans make it plain that there is no conflict between welding and riveting at the present time, each having its own sphere and continuing to be used.

The interesting evolution of blast furnace fuels is described in an article in *Industrial and Engineering Chemistry.* Charcoal was the principal fuel for centuries, and in America it was but natural that it should be used, for timber was plentiful and much of it had to be cut to clear the soil. Both raw coal and coke, however, had been used in Europe for smelting iron ores prior to 1651, but in this country it was not until 1855 that anthracite iron passed charcoal iron in volume of output; in 1869 bituminous fuel also passed charcoal. In 1875, bituminous fuel passed anthracite, and has now become the principal fuel. Originally this was all beehive coke, but this reached its maximum production in 1916, only to be passed by by-product coke in 1919, and today only one-quarter of the coke used is from beehive ovens. By-product coke making has increased forty fold in twenty-five years. For the last year the figures are available, over 49 million net tons of coal were used in by-product ovens, and the by-products had a value of $103,840,550, or about one-half the value of the coal used.

EFFECT OF HEAT ON WORKERS

The United States Bureau of Mines and the United States Public Health Service have recently collaborated with the Society of Heating and Ventilating Engineers in an effort to determine how much heat a worker can endure without suffering any ill effects. As a result of the tests made, many time-honored ideas have been shattered, and facts and figures have been arrived at that stress the importance of maintaining proper atmospheric conditions in machine shops and foundries.

Perhaps the most interesting finding made by the investigators was the fact that a robust man, stripped to the waist, would remain normal for an indefinite period even though working in an atmosphere registering 90 degrees F., and 100 per cent relative humidity. The man's endurance, of course, decreased in proportion to the intensity of his physical labors. Another test proved that the consumption of large quantities of ice water by workers subjected to great heat was, in no case, harmful. In fact, several of the men, after long exposure to high temperature and exertion, drank as much as a quart of ice water in 15 minutes without any ill effects.

It is commonly known that many industrial workers suffer from an eye disease called conjunctivitis. Experiments revealed that perspiration entering the eye was responsible for the disease. The experimenters recommend that workers who are subjected to great heat be provided with sweat bands to be worn above the eyes.

Current Editorial Comment

in the Machine-building and Kindred Industries

THE SHOP EQUIPMENT SHOWS

The three expositions of machine tools, shop accessories and heat-treating equipment to be held during September, will present the products of nearly 500 American manufacturers to the attention of industrial and shop executives responsible for economical production. The exposition of the National Machine Tool Builders' Association at Cleveland during the week beginning September 19 will feature principally the latest developments in machine tools and accessories. The exposition of the American Society for Steel Treating to be held in Detroit during the same week will feature especially steel of all kinds, heat-treating equipment and small tools. The exhibition in New Haven beginning September 6, will bring to the attention of the New England industries many of the latest developments in machine tools and small tools.

Never before in the history of the machine-building industries have so many new developments in machinery, tools and equipment been placed on exhibition. No man responsible for the output of a machine shop can afford not to visit one or more of these shows, for they will provide a liberal education in modern machine shop practice. Most of the equipment will be shown in operation, thereby adding greatly to the value of a visit.

QUALITY CONSTANTLY ADVANCES

Sometimes we hear expressions indicating that present-day products are inferior to those made in the past. For example, some believe that automobile engines built perhaps five years ago are better than engines now manufactured; and in 1922 the notion also prevailed that the engines built before the war were decidedly superior in quality. This same idea that "things are not that what they used to be" is related to other lines of manufactures, but such an opinion is rarely justified, especially when applied to machine shop products.

When have manufacturers used better raw materials, such as steels, castings, and non-ferrous alloys? When have shops been equipped with tools capable of higher precision or quality? When has more efficient or durable machinery been built?

The machine-building industry as a whole has never given so much in quality as at the present time. The improvements cover not only design, but materials and workmanship. Consider, for example, the present-day application on many classes of machinery of such improvements as hardened and ground gears, anti-friction bearings, convenient means of control, improved lubricating systems, safety appliances for the protection of both machine and operator, and numerous other developments well known to MACHINERY'S readers. The accuracy and interchangeability of parts made possible both by modern tool and gaging developments is another important advance.

Improvements in the quality of machine shop products reflect the developments in modern machine tools and small tools. The equipment represented in this number of MACHINERY by 561 advertisers greatly excels in accuracy and efficiency the designs of a few years ago. And now, as never before, it is possible to profit by using tools which are modern, not merely because they are new, but because they are economical in operation. This is a good point to keep in mind when looking for leaks in your shop, due to waste of time and effort.

MACHINING LARGE WORK

The problems to be solved in machining heavy forgings and castings are quite different from those encountered in shops building comparatively small machinery or devices. The cost of handling and machining a single large machine part weighing several tons, of which frequently only one is required at a time, is so great that unless the methods of machining it are very carefully considered, a loss instead of a profit may result.

The selection of suitable machine tools for heavy work requires even more care and thought than those for light manufacture. The investment in a heavy machine tool is so large that, if the tool is to pay for itself, it must be reasonably well employed at all times; and it is not so easy to keep a heavy machine constantly at work as it is a smaller tool.

As a rule, it is more important that heavy machine tools be unusually rigid and capable of heavy cuts, than that they be designed to run at high speeds. On large castings and forgings, the allowances for machining are necessarily large, and heavy cuts are, therefore, of great importance. Very high speeds, on the other hand, are not always suitable, because of the momentum created by the heavy revolving or otherwise moving parts of the machine and of the work.

Portable machine tools, of which many have been developed during recent years, offer a valuable aid in the machining of heavy work, because when heavy pieces must be handled, it is much easier to bring the machine to the work than to move the work to the machine. The portable machine tools make possible a saving in two ways. Their first cost is less, and they save considerable expense by making unnecessary the moving of heavy machine parts around the shop. Frequently, too, they have a wider range of application than a single large stationary machine.

The development in the design of portable machine tools has been accelerated by improvements in electric motors and their controls. Motors mounted directly on these portable tools are in general use, and they can be quickly put to work wherever an electric power line is available. It is likely that for heavy work, portable tools of all kinds will be used to an ever-increasing extent in the future.

The American Machine Tool Industry

A Brief Historical Review of the Development of a Basic Industry

By ERIK OBERG

THE history of the machine tool industry in the United States goes back approximately one hundred years, although most of the important developments have taken place since the Civil War. It is of interest to note how the machine tool industry, which was located at first entirely in the extreme East, has gradually expanded westward. A brief review of this westward movement is of especial interest, because it is also an indication of the westward movement of the machine-building and metal-working industries as a whole —the machine-tool using industries.

The present article, therefore, will briefly review the development of the machine tool industry in this country. It will present statistics of the growth of the industry and of its present state of development. In this connection it will also be of interest to locate—approximately, at least—the center of the machine tool industry, somewhat in the same way as the center of population is located each ten years by the United States Bureau of Census. As is well known, the center of population is moving westward. At the last census it was located in the southwestern part of Indiana, having moved about eight miles westward in the preceding ten years. The center of the machine tool industry has also constantly been moving westward during the last fifty years. It moved in that direction somewhat slowly during the seventies, then quite rapidly during the eighties and nineties, and again more slowly during the last twenty-five years. See page 47 for its present location.

Early Machine Tool Centers

About 1870, practically all the machine tool building shops in the United States were located in New England, New Jersey, and eastern Pennsylvania. The important machine tool building centers at that time were Providence, Hartford, Worcester, Fitchburg, Windsor, Vt., Philadelphia, and Newark, N. J. The only machine tool builder in western New York state of any importance at that time was William Gleason, who started the Gleason Works in Rochester in 1865, and the only important shop west of the Alleghenies, building machine tools, was the Western Machine Works in Cincinnati, formed by John Steptoe and Thomas McFarlan. This shop employed about 300 men in the early seventies. Most of the early pioneers in the machine tool building business in Cincinnati at one time or another worked in the John Steptoe shop, at that time building a varied line of tools.

New England, the Cradle of the Machine Tool Industry

In the United States, New England may well be called the cradle of the machine tool industry. In Providence, the Brown & Sharpe Mfg. Co., was the leading and practically the only machine tool building plant fifty years ago. It was founded in 1833

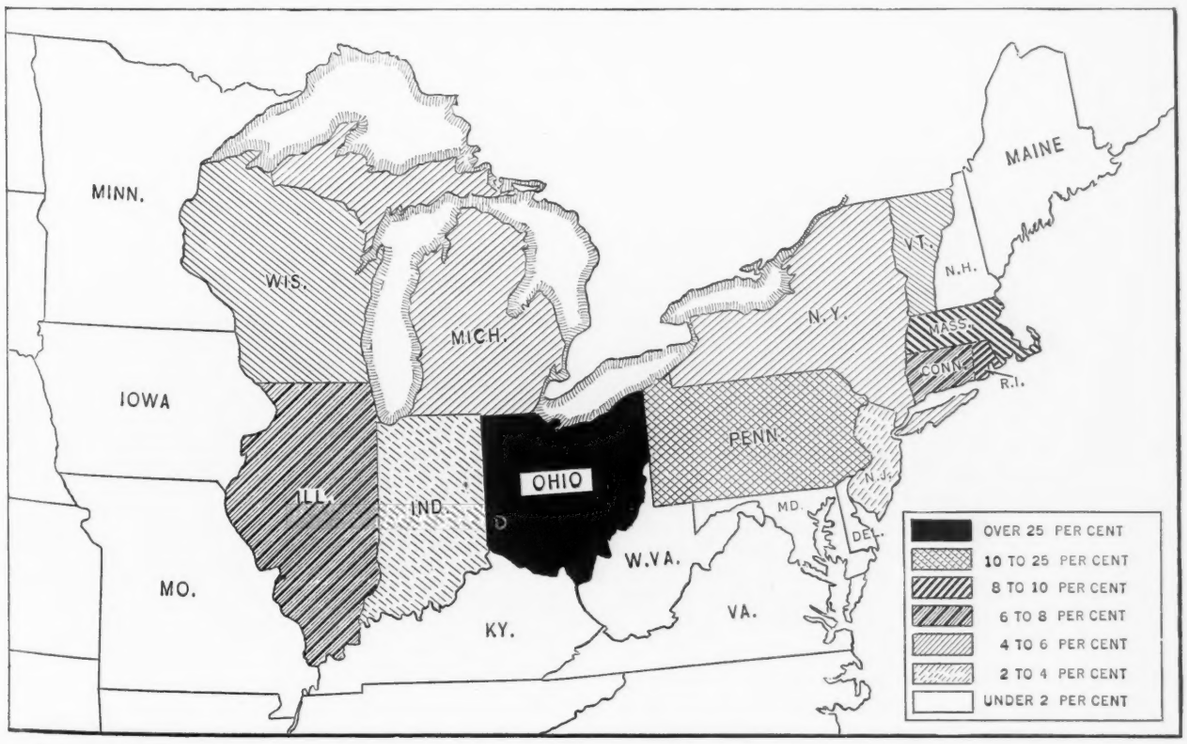


Fig. 1. Production of Machine Tools in the United States in 1925, Showing the Percentage Built in Each State

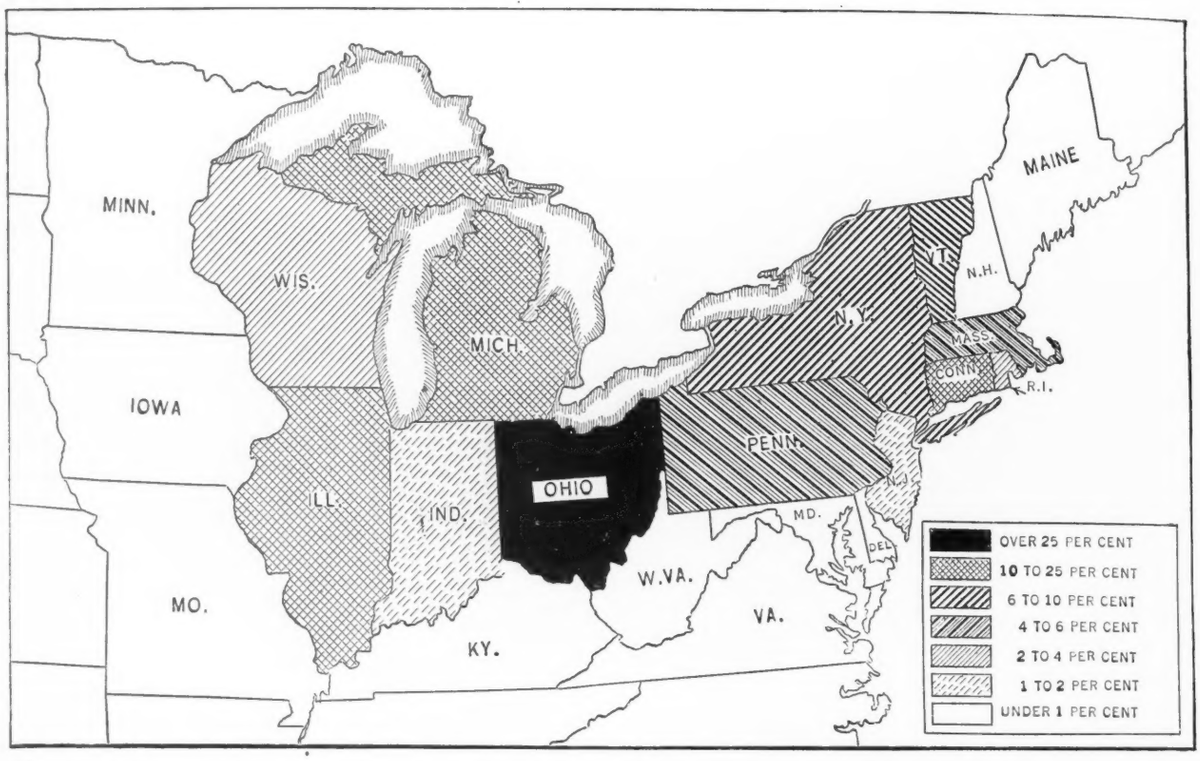


Fig. 2. Production of Parts and Attachments for Machine Tools in 1925, Showing the Percentage Made in Each State

by David Brown and his son, Joseph R. Brown, but became a machine tool building shop first about 1853, when Lucian Sharpe became a partner, and the firm was called J. R. Brown & Sharpe. In 1868, the firm incorporated under the name, The Brown & Sharpe Mfg. Co.

In Hartford, Conn., the two leading firms in the field fifty years ago were the Pratt & Whitney Co., and the Billings & Spencer Co. Pratt and Whitney, the founders of the former company, started their partnership in 1860, and formed the Pratt & Whitney Co. in 1869. The Billings & Spencer Co. was formed the same year.

Machine tool building early became one of the industries of Worcester, Mass. Currier & Snyder began building drills in 1833, and among the early machine tool builders there were the Carter Whitcomb Co., formed in 1849, the P. Blaisdell & Co., formed in 1865, the Shepard, Lathe & Co., the Lathe, Morse & Co., the Draper Machine Tool Co., and the original Reed & Prentice Co., started by A. F. Prentice. The Heald Machine Co. was originally started at Barre, Mass., in 1826, and hence, dates back further than any of the other New England concerns. It is still in the hands of the same family that started the business.

A machine tool building community almost as old as Worcester is found in Fitchburg. Here John and Salmon W. Putnam started the Putnam Machine Co. about 1838. The first machine made by them for the market was a gear cutter, and they soon developed a full line of standard machine tools. The Putnam Machine Co. was incorporated in 1858.

In Windsor, Vt., a machine tool building plant of considerable importance grew out of the gun shop of the Robbins & Lawrence Co., started about 1838. The mechanical history of this shop runs back

Table 1. Production of the Machine Tool Industry in the United States
(Based upon the Census of Manufactures for 1925—Total Value of Machine Tools Produced, $91,459,403)

State	Value of Product	Per Cent	State	Value of Product	Per Cent	State	Value of Product	Per Cent
Ohio	$25,394,838	27.8	Illinois	$5,965,672	6.5	Vermont	$4,102,264	4.5
Pennsylvania	10,488,193	11.5	New York	5,435,887	5.9	Indiana	3,214,084	3.5
Massachusetts	7,589,750	8.3	Michigan	5,379,617	5.8	New Jersey	3,127,802	3.5
Connecticut	7,157,646	7.8	Wisconsin	4,129,124	4.5	All other states	9,474,526	10.4

Machinery

Table 2. Production of Parts and Attachments for Machine Tools
(Based on the Census of Manufactures for 1925)

State	Value of Product	Per Cent	State	Value of Product	Per Cent	State	Value of Product	Per Cent
Ohio	$8,264,085	25.7	New York	$2,212,661	6.9	New Jersey	$523,425	1.62
Connecticut	4,656,946	14.5	Massachusetts	1,657,001	5.1	Indiana	464,733	1.44
Michigan	4,198,124	13.0	Pennsylvania	1,481,267	4.6	Missouri	296,565	0.92
Illinois	3,751,542	11.7	Wisconsin	1,089,822	3.4	All other states	450,600	1.40
Vermont	2,494,713	7.7	Rhode Island	651,118	2.02	Total	32,192,602	100.00

Machinery

Table 3. Production of Machine Tools in 1925 (Bureau of Census)

Kind and State	Number of Machines	Value
Total Value for the United States	.....	$91,459,403
Ohio	.....	25,394,838
Pennsylvania	.....	10,488,193
Massachusetts	.....	7,589,750
Connecticut	.....	7,157,646
Illinois	.....	5,965,672
New York	.....	5,435,887
Michigan	.....	5,379,617
Wisconsin	.....	4,129,124
Vermont	.....	4,102,264
Indiana	.....	3,214,084
New Jersey	.....	3,127,802
All other states	.....	9,474,526
Totals for Different Types of Machine Tools		
Bending machines	807	641,711
Illinois	585	116,323
Ohio and Pennsylvania	106	361,431
Michigan and Wisconsin	28	53,609
All other states	88	110,348
Boring machines	802	3,032,026
Horizontal	583	1,687,889
Illinois	70	217,110
New Jersey	240	57,377
Connecticut and Massachusetts	129	558,843
Ohio and Pennsylvania	99	577,860
All other states	45	276,799
Vertical	219	1,344,137
Ohio and Pennsylvania	121	847,397
All other states	98	496,740
Broaching machines	435	540,093
Michigan	207	150,579
Conn., Mass., and New York	108	146,615
All other states	120	242,899
Cutting-off machines	1,786	496,537
Rotary cutter type	250	294,168
New York	91	121,575
Illinois and Ohio	66	52,181
All other states	93	120,412
Hacksaw type	1,536	202,369
Drilling machines	8,148	7,045,693
Multiple-spindle	1,211	2,109,738
Illinois	216	463,418
Michigan	163	226,305
Ohio	217	425,274
Conn., Mass., and Rhode Island	212	253,456
Indiana and Wisconsin	403	741,285
Radial	831	2,039,834
Ohio	743	1,803,214
Michigan and Wisconsin	46	92,398
All other states	42	144,222
Sensitive	3,577	1,776,238
Ohio	642	198,108
Connecticut, Massachusetts, and New Hampshire	1,551	951,372
All other states	1,384	626,758
Vertical (upright)	2,529	1,119,883
Illinois	1,150	357,890
Indiana and Ohio	721	419,265
Massachusetts and New York	395	323,198
All other states	263	19,530
Forging machines	85	779,320
Bolt, nut, and rivet	18	219,810
Bulldozers and others	67	559,510
Gear-cutting machines	1,271	4,258,350
Formed, cutter type and others	624	2,232,615
Generator, hobbing type	647	2,025,735
Grinding machines	.....	10,733,890
Cylindrical	.....	3,644,575
Plain	.....	3,136,075
Universal	330	508,500
Mass., and Rhode Island	136	219,311
Mich., Ohio, and Penn.	194	289,189
Surface	894	1,466,760
Massachusetts	241	784,800
Conn. and Rhode Island	452	425,550
Ill., Mich., and Wis.	159	241,788
All other states	42	14,622
Cutter, tool and knife	1,548	1,769,773
Connecticut	110	118,365
Massachusetts	174	75,071
Illinois and Wisconsin	47	22,890
All other states	1,217	1,553,447
Internal	765	2,005,278
Other Types	.....	1,847,504
Massachusetts	.....	433,647
Michigan	.....	156,536
Pennsylvania	.....	133,112
Conn., Rhode Island, and Vermont	.....	400,914
Illinois and Ohio	.....	666,555
All other states	.....	56,740
Hammers (not portable)	855	829,462
Drop	201	407,608
Steam, pneumatic, and belt or motor-driven	654	421,854
Lathes	.....	$16,344,574
Engine	5,165	7,675,897
Ohio	2,615	4,756,805
Conn., Mass., and N. H.	722	1,209,486
N. J., N. Y., and Pa.	169	795,471
Illinois and Kentucky	210	138,713
All other states	1,449	775,422
Bench	930	397,627
Massachusetts	525	122,167
Illinois and Ohio	196	193,110
All other states	209	82,350
Turret (including hand-screw machines)	1,567	4,155,054
Conn., Rhode Island, and Vt.	608	1,991,355
New York and Ohio	577	1,264,919
Indiana and Wisconsin	382	898,780
Other types	.....	4,115,996
Illinois	.....	315,301
Michigan	.....	692,956
Conn., Mass., R. I., and Vt.	.....	2,605,660
All other states	.....	502,079
Milling machines	.....	6,488,596
Hand feed	450	207,855
Conn., Mass., and Rh. Island	81	39,437
Ohio and Pennsylvania	304	146,112
All other states	65	22,306
Power feed	.....	6,280,741
Plain	723	1,624,617
Universal	599	1,360,884
Conn., Mass., and Rhode Island	295	597,185
Illinois and Ohio	228	568,731
All other states	76	194,968
Vertical	333	860,080
Illinois and Ohio	169	516,850
Massachusetts and Rhode Island	88	186,654
All other states	76	156,576
Lincoln type	374	679,101
Planer type	121	1,022,037
Other types	.....	734,022
Pipe-cutting and threading machines	2,637	1,304,858
Michigan	148	118,004
Connecticut and Massachusetts	257	166,285
Illinois and Ohio	1,586	556,341
All other states	646	464,228
Planers	193	1,104,786
Massachusetts	23	98,325
Ohio	133	858,360
All other states	37	148,101
Portable tools	.....	11,896,325
Drills, electric and pneumatic	92,558	4,097,152
Ohio	26,312	1,054,027
All other states	66,246	3,043,125
Hammers, pneumatic (chipping, riveting, calking, etc.)	53,104	6,049,773
Grinders, electric	18,500	1,122,167
Ohio	2,620	305,170
Connecticut and Massachusetts	249	28,275
Illinois and Wisconsin	361	33,460
All other states	15,270	755,262
Other types	.....	627,233
Presses	.....	7,994,953
Hydraulic	1,053	1,673,322
Bending and forming	1,015	1,592,075
Forging	38	81,247
Power, for sheet-metal work	.....	6,321,631
Illinois and Indiana	.....	293,190
New Jersey and New York	.....	1,794,709
All other states	.....	4,233,732
Punching machines	1,034	1,910,160
Riveting machines	.....	687,519
Screw machines (automatic)	2,301	5,919,266
Multiple-spindle	1,140	3,971,721
Single-spindle	1,161	1,947,545
Shapers	1,125	1,614,760
Connecticut	169	212,500
Ohio	537	680,954
Massachusetts and Rh. Island	53	64,735
All other states	366	656,571
Shears (power)	1,892	1,351,204
Illinois	344	139,033
Ohio	663	407,580
Pennsylvania	26	40,497
Del., New Jersey, New York	414	397,184
Indiana and Wisconsin	403	343,697
All other states	42	23,213
Slotters	62	404,968
Connecticut and Massachusetts	41	72,588
New York and Pennsylvania	21	332,380
Threading machines (not pipe)	570	839,520
Die type	153	171,127
Milling type	81	344,106
Tapping machines	336	324,287
All other machine tools	.....	5,240,832

even further than this. Later, this company became the Windsor Mfg. Co., and in 1869 the Jones, Lamson & Co., the forerunner of the Jones & Lamson Machine Co., moved to Springfield, Vt. The Windsor shops then became the Windsor Machine Co., and are now part of the National Acme Co.

Early Machine Tool Building in Philadelphia and Newark

In Philadelphia, William Sellers began to build machine tools in 1848, the firm of William Sellers & Co., being formed in 1855. William B. Bement began to manufacture machine tools about 1850, and in 1870 this firm was known as William B. Bement & Son. Owing to the fact that the Baldwin Locomotive Works were located in Philadelphia, there was a demand for heavy machine tools in that locality, and from the beginning, both Sellers and Bement specialized on a heavier and larger class of machine tools than those manufactured in New England.

It may not be generally known that Newark, N. J., also ranks as one of the places where machine tool building was developed at an early period. Gould & Eberhardt, one of the oldest firms in the machine tool building business, was established there in 1833. It was first known as the Gould Machine Co., and built a line of lathes, planers, and drilling machines.

Beginning of the Machine Tool Industry in Ohio and the Middle West

Between 1870 and 1880, there was some activity in the development of a machine tool industry in Cleveland, Cincinnati, and Hamilton, Ohio, and Rockford, Ill. Henry Bickford began building upright drills in Cincinnati in 1874, and from this business has sprung the Cincinnati-Bickford Tool Co. The Niles Tool Works in Hamilton began to devote themselves to machine tool building about 1876, and W. F. & John Barnes Co., in Rockford, Ill., began making jig saws in 1872 and small lathes and drilling machines in 1878.

It was first in the early eighties, however, that a machine tool industry of some importance began to grow up in Ohio. At this time, the Warner & Swasey Co. started in Cleveland, and several of the shops in Cincinnati which have since come to occupy important places in the machine tool building field engaged in the building of machine tools. Among the early pioneers were William Lodge and William Oesterlein, both of whom had been employed by the John Steptoe Co.; Frederick Holtz, who began making screws and taps about 1880, and from which business developed the Cincinnati Milling Machine Co.; and G. A. Gray, who started in 1883 first building lathes, and later specializing on planers.

Comparative Statistics of the Machine Tool Industry

No statistics are available to show either the number of machine tool plants in existence or the value of the product manufactured until 1899. By that time the Ohio machine tool builders had become well established; and the proportion between the machine tool business located in New England and that located in Ohio, while fluctuating, has not changed to a great degree in the last twenty-eight years. But the relative importance of New York, New Jersey, and Pennsylvania as machine tool building states has decreased, while the importance of Illinois, Indiana, Michigan, and Wisconsin has increased.

Table 4. Production of Metal-working Machinery Other Than Machine Tools in 1925
(Bureau of Census)

Kind and State	Value
Total value for the United States	$47,352,746
Rolling-mill machines	15,001,162
Ohio	3,554,771
Pennsylvania	6,818,408
All other states	4,627,983
Sheet-metal working machines	17,467,548
Illinois	1,974,712
New York	5,490,202
California and Washington	553,396
Connecticut and New Jersey	4,893,613
Iowa, Missouri, and Minnesota	373,355
Maine, Rhode Island, and Vermont	28,505
Michigan and Ohio	3,959,980
All other states	193,785
Welding machines	1,175,536
Wire-drawing machines	670,559
Massachusetts	197,470
New York, Ohio, and Pennsylvania	439,419
All other states	33,670
Wire-working machines	2,141,750
Connecticut	1,014,360
Wisconsin	242,861
Illinois, Indiana, and Iowa	215,034
New Jersey, New York, and Pennsylvania	406,682
All other states	262,813
All other metal-working machinery	10,896,191

Machinery

In 1899 the total value of the metal-working machinery built in the United States was about $25,000,000, of which machine tools represented $18,000,000. The statistics for 1899 do not show separately for each state the value of the machine tools built, but include all metal-working machinery. The New England states were responsible for 32 per cent of the total; New York, New Jersey, and Pennsylvania, for 26 per cent; Ohio, for 30 per cent; and Illinois, Indiana, Michigan, and Wisconsin for practically the entire remainder—12 per cent.

In 1904, the depression in the machine tool industry affected the Ohio manufacturers more than those in New England, so that of the total production of metal-working machinery in that year, the New England states were responsible for 35 per cent; New York, New Jersey, and Pennsylvania for 24 per cent; Ohio for 25 per cent; while Illinois, Indiana, Michigan, and Wisconsin had increased their quota to about 16 per cent. The total production of metal-working machinery in 1904 was valued at $32,000,000, of which $18,000,000 represented machine tools. These figures show that there was no increase in the value of the machine tools produced in 1904 as compared with 1899—due doubtless to the depression in the latter year.

The Census of Manufactures for 1914

Unfortunately, the census of the machine tool industry has often been taken in years when this industry was subject to a depression. The next census after 1904 was that of 1914, when machine tools were classified entirely by themselves. According to this census, the total value of the machine tools produced in that year was $31,500,000.

Of this total New England was responsible for 35 per cent; New York, New Jersey, and Pennsylvania for 18 per cent; Ohio for 29 per cent; and Illinois, Indiana, Michigan, and Wisconsin for about 18 per cent. These figures show that New York, New Jersey, and Pennsylvania lost in relative importance as machine tool producing states, as compared with 1899 and 1904, while the states west of Ohio gained. The balance between New England and Ohio remained practically the same as in 1899.

The Machine Tool Industry in 1918

The great development that took place in the machine tool industry from 1914 to 1918 did not materially affect the balance between New England and the middle western states that has been maintained with comparatively small changes for the last twenty years. Census figures are not available showing the total value of the products of the machine tool manufacturers in 1918, but an estimate may be based upon the total number of men employed in the industry in 1918 (77,000) from which it may be assumed that the total value of the machine tools built in that year was between $300,000,000 and $400,000,000.

A tabulation of the number of men employed in the machine tool industry in 1918 was made by the Machine Tool Section of the War Industries Board. According to these figures, New England, in 1918, employed 34.6 per cent of the workers in the industry; Ohio, 27.9 per cent; New York, New Jersey, and Pennsylvania, 20.5 per cent; while Illinois, Indiana, Michigan, and Wisconsin employed 15.3 per cent, the remaining 1.7 per cent being scattered over a number of the other states.

The 1925 Census, the Latest Record of the Industry

The total value of the machine tools produced in 1925, according to the Bureau of Census, was $91,459,403. The total value of parts and attachments for machine tools was $32,192,602. Table 1 gives the production of the leading machine tool-building states; the totals for the different states have been given separately in all cases where the figures could be published without disclosing the operations of individual plants. It will be noticed that Rhode Island is missing from the enumerated states; this is included under the total "All other States" at the end of the table, because one plant in that state is very much larger than all the others put together. From past statistics, it is possible to deduce quite accurately, however, that the production of machine tools in Rhode Island is somewhat over 8 per cent of the total produced in the United States. Thus it may be concluded that in 1925, New England was responsible for somewhat over 29 per cent of the total production; Ohio, 27.8 per cent; Pennsylvania, New York, and New Jersey, 20.9 per cent; Illinois, Michigan, Wisconsin, and Indiana, 20.3 per cent, with the remainder scattered.

Table 2 shows the production of parts and attachments for machine tools, giving the percentage figures for the leading states. Table 3 gives detailed production figures for different kinds of machine tools, while Table 4 gives the production of metal-working machinery, other than machine tools, in 1925. The parts and attachments for metal-working machinery other than machine tools were valued at $409,687.

The accompanying maps, Figs. 1 and 2, show graphically, the value of machine tools, and parts and attachments for machine tools, manufactured in different states.

Unfortunately, no statistics are available on the production of machine tools, considered by themselves, for the different cities in the United States. The statistics available cover metal-working machinery as a whole. Table 5, which is based upon a compilation by the Bureau of Census, gives data of the production of all metal-working machinery, including machine tools, for 1925. This table gives statistics for all the larger cities for which separate totals can be published without disclosing the operations of individual establishments. It will be noted that so important a machine tool-building center as Providence, R. I., for example, is missing, this being because the leading concern in that city is so large that separate statistics would disclose approximately, at least, the figures for that one concern.

Table 5. Important Cities Building Metal-working Machinery, Including Machine Tools

(Based on Bureau of Census Statistics for Production in 1925)

City and State	Value of Products	Value of Materials	Wages	Wage Earners	Establishments
Cleveland, Ohio ..	$14,342,399	$4,647,648	$4,455,903	2817	21
Cincinnati, Ohio .	13,114,208	4,590,013	4,691,711	3171	35
Worcester, Mass. .	11,147,569	2,642,327	2,381,493	1590	13
Detroit, Mich. ...	6,510,558	1,994,981	2,063,825	1222	13
Rochester, N. Y. .	5,797,504	1,442,684	1,745,197	1041	6
Hartford, Conn. ..	5,042,306	1,035,584	2,474,894	1452	10
Philadelphia, Pa. .	4,912,679	2,485,337	993,551	730	10
Toledo, Ohio	4,617,743	1,423,846	1,955,114	1230	7
Chicago, Ill.	3,904,026	1,204,152	1,321,835	718	16
Newark, N. J.	3,234,665	1,044,674	1,564,475	871	7
Rockford, Ill.	2,224,803	871,788	636,703	413	6
Hamilton, Ohio ...	2,195,909	923,181	972,181	695	4
Jackson, Mich. ...	1,305,300	344,366	345,206	235	6
Bridgeport, Conn. .	1,147,613	346,196	434,600	323	11
St. Louis, Mo. ...	625,269	132,669	228,658	162	4
Dayton, Ohio	479,703	112,576	185,877	129	5
Waltham, Mass. ..	465,581	64,700	210,412	161	4
Minneapolis, Minn.	334,728	51,723	41,381	29	3
Boston, Mass.	267,637	55,709	126,968	72	4
Nashua, N. H. ...	192,923	77,573	63,421	50	3

Machinery

It may be estimated, however, on the basis of the number of men employed in machine tool building in different cities of the country during the war, that Providence would take its place between Worcester, Mass., and Detroit, Mich.

The figures given in Table 5 represent the total output of establishments engaged *primarily* in the manufacture of metal-working machinery.

Location of the Center of the Machine Tool Industry

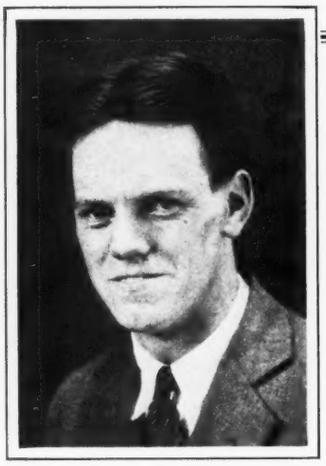
If one were to attempt to locate the center of the machine tool industry in the United States in the same way as the center of population is located, one would find it approximately on a line passing north and south just east of Erie, Pa. Slightly more than one-half of the machine tools in the United States are built in New England, New York, New Jersey, Maryland, Delaware, and Pennsylvania. Very nearly one-half are built in Ohio and the states west of Ohio.

Saving Material by Face Grinding

By A. M. HAMMOND, Diamond Machine Co., Providence, R. I.

DURING the last few years, many articles have appeared in the technical press having to do with various features of face grinding—the machines themselves; the saving in time made possible by their use; and the design of work that is to be finished in this way. More recent developments have improved the design of the machine, the method of drive, and other details, with the result that the importance of face grinding as a method of producing flat surfaces has increased.

There are still some points to which shop executives have not given as serious consideration as they deserve. Possibly the point in which the author is particularly interested here has nearly escaped attention because, as a means of economy, it has been somewhat overshadowed by the saving in time. This point is the saving of metal which can be made by face-grinding parts that would otherwise be finished on other types of machines. The saving is due to the reduced "allowance for finish" on castings to be face-ground, as compared with the allowance necessary if the machining is to be done according to usual shop practice. The face grinding machine produces a flat surface at once, whether it cuts below the hard surface "skin" of the casting or not, while the steel cutting tool must penetrate this surface on the first "roughing cut," and then go over the entire surface one or more times to finish the work.



ALDEN M. HAMMOND was graduated from the mechanical engineering department of the Massachusetts Institute of Technology in 1922. Immediately upon graduation, he enrolled as an engineering apprentice with the Terry Steam Turbine Co., Hartford, Conn., serving in the shop assembling and testing departments and later in the engineering department. Leaving this company, he went with the Whitlock Coil Pipe Co., also of Hartford, Conn., where he was employed in several shop departments and in the engineering laboratory, finally becoming connected with the sales and publicity end of the business. He is now connected with the sales department of the Diamond Machine Co., Providence, R. I.

The difference between the allowances for finish is the metal saved, and this can easily amount to 3/16 or 1/4 inch or more over the entire surface to be finished, as 1/16 to 1/8 inch allowance, depending on the size and shape of the piece, satisfies the requirements of the face grinding machine. On one piece or just a few pieces this saving is unimportant, but in terms of the saving on a good-sized run or on a year's production, it becomes important enough to warrant pattern changes and more exacting foundry methods.

Examples of Savings of Material

Definite figures brought out by the Nielsen Surveys covering the work of Diamond face grinding machines at several different plants prove the truth of this statement. At the plant of the Riley Stoker Co. in Detroit, for instance, on six typical pieces of varying size, the saving in material ranges from 3.5 to 18.2 pounds per piece, representing a saving of from 9 to 49 cents per piece, added to the saving in time, which in the case of one piece, amounts to $2.65 per casting.

At the Beardsley & Piper Co.'s plant in Chicago, a saving on five pieces amounts to from 27 cents to $3.34 per piece in material alone. It is interesting to note that on one of these pieces, the saving in material was all that made it advantageous to finish the part on the grinding machine.

Again, at the Cochrane Corporation's plant in Philadelphia, the engineers reported an average

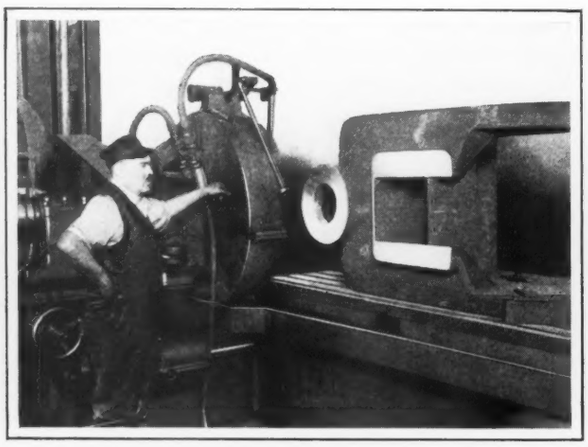


Fig. 1. A Face Grinding Operation at the Plant of the Beardsley & Piper Co., where a Surface 42 by 19 Inches, Including a Hub with a Ground Surface 4 1/2 Inches Wide, is Finished in 9 Minutes

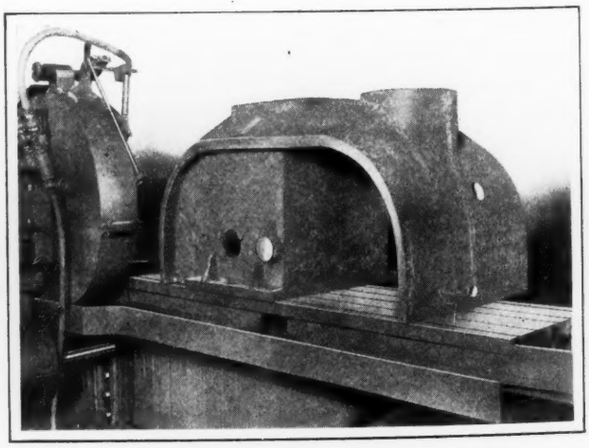


Fig. 2. Another Grinding Job at the Beardsley & Piper Co.'s Plant, where a Rim 1 1/2 Inches Wide on a Casting 58 1/2 Inches Long by 26 Inches High is Ground in 6 Minutes, Removing 3/16 Inch of Stock

ratio of old to new time on all parts ground of approximately 4.1. After pointing out that this means a saving during an average year of $3027.50 or a return of 33.6 per cent on the investment, the investigators add: "Still another saving to be credited to the grinder is the saving in the cost of castings resulting from the fact that less stock is now required for machining. This also effects a saving in the cost of shipping the castings from the foundry to the plant. Considerable expense was involved in changing patterns, but the saving in iron and freight has now repaid that cost. Future savings from this source will be net credits against the cost of the grinder, tending to make the investment pay even larger returns than here shown."

Warren Webster & Co. figure that during the first year that they used their face grinding machine, they saved 57,291 pounds of metal worth $3478.26, and this material saving was even greater than the saving in time, which amounted to $2003.32. They consider the total saving of $5481.58 (65 per cent on their investment) as a forceful argument in favor of grinding.

The Westinghouse Electric & Mfg. Co. carefully designs the work to be done on the face grinding machine, and has experimented to see just how little material can be allowed for finish. The result is that only 1/16 to 1/8 inch is allowed, depending upon the size and shape of the casting, except in cases where flanges having a dimensional allowance of 1/16 inch are ground, in which case no allowance whatever is made for finish.

Consider the manufacturing advantage this gives a firm using face grinding machines over a firm using other methods. As a striking example of this, the writer knows of a contract which was recently let, covering some 25,000 cast-iron tunnel-sections, on which a total saving of 1125 tons of cast iron could have been made, had the patterns been designed for a face grinding machine finish. This saving is exceptional for a single job, but in this day of quantity production, it is the few cents saved on one part and the few more on another which, in the aggregate, make the difference between success and failure.

The Cooperation Required to Obtain Best Results

While everything pointed out in this article is possible, to get the best results, everyone concerned must cooperate. It is a process of education from the beginning to the end. The draftsman must be educated to keep in mind the fact that the work is to be ground, and must design his work accordingly; the foundryman must be educated to the necessity of producing castings as near the limits as possible (and he can do it when he is convinced that other foundrymen have done so!); the machine shop foreman must be educated to the difference between face grinding and other methods, so that he will demand and get the most satisfactory results possible from his high-speed, expensive equipment.

This article has been prepared to emphasize one feature that has not been given sufficient attention, not with any idea of lessening the emphasis placed on the saving in time made possible by face grinding, but rather as an additional point to be added to this decided advantage.

AN EXTREMELY ACCURATE LEAD-SCREW

A 25-foot long master lead-screw of remarkable accuracy has recently been completed by the Pratt & Whitney Co. of Hartford, Conn., for the Boye & Emmes Machine Tool Co. of Cincinnati, Ohio. Many screws of even greater accuracy have been made in the laboratory of the Pratt & Whitney Co. but these were not more than 2 or 3 feet in length. The making of a lead-screw in a strictly commercial way, that has a maximum variation from perfect of less than 0.001 inch over a length of 25 feet is a real achievement. The Pratt & Whitney Co. feels that it is much easier to make a 2-foot screw to a tolerance of 0.0001 inch, than to make a screw 25 feet long to a tolerance of 0.001 inch.

For purposes of inspection, the screw was hypothetically divided into 3-inch sections, and a report made on the variations from the beginning of one section to the other. Five of the sections showed an error of 0.0004 inch; eighteen, an error of 0.0003 inch; and forty-four, of 0.0002 inch or less.

The maximum error from perfect at any point on this screw is minus 0.0009 inch at the sixty-fourth section and plus 0.0006 inch at the fifty-second section. This slight imperfection in the screw will be almost entirely removed when the screw is used in connection with a nut 8 or 10 inches in length. The Boye & Emmes Machine Tool Co. will use the screw for generating lead-screws for lathes.

* * *

FIFTY-SEVEN DAYS WITHOUT AN ACCIDENT —HOW IT WAS DONE

According to H. G. Dent, safety supervisor of the Chicago plant of Joseph T. Ryerson & Son, Inc., this company recently operated fifty-seven consecutive days without a single accident resulting in lost time. "Our working force, approximately 400 men," says Mr. Dent, "operates every type of machine used in the ware-housing of steel and machinery. Safety work has been carried on continuously since 1915 and a number of departments have operated for several months without a lost-time accident. To achieve a No-Accident month for the entire plant it was necessary to arouse the interest of everyone in the organization. This was accomplished by staging a funeral march and burial, and by inducing each man to sign a safety pledge. At noon on the first working day in May a ten-piece band started to parade from the extreme end of the plant, followed by two pall bearers carrying a first aid stretcher on which was a hideously maimed life-sized dummy representing "Old Man Carelessness." As the parade passed through the various departments, each foreman had his men fall in line. The parade proceeded to the main entrance, opposite which a hole had been dug. A specially prepared safety talk gave the men food for thought. Immediately after the burial, a wooden headstone was erected, flowers planted and the plot seeded.

"After going through the month of May successfully, the program was carried on until June 16 when a minor infection caused a loss of several days. Since the previous lost-time accident occurred, April 19, a record of fifty-seven days without a single lost-time accident was established."

Heat-treatment of Die-blocks

Tentative Practice Approved by the Recommended Practice Committee of the American Society for Steel Treating

THE recommended heat-treatments to be described are intended for die-blocks made from plain carbon and from alloy steels, and they are only suitable for die-blocks having the chemical compositions given in the accompanying tables. The steels listed in these tables are not recommended as the most suitable for die-blocks, as there are many other steels that are equally satisfactory.

Prior to any heat-treatment, the die-blocks should be hot-forged on the six sides in order to more effectively refine the grain. In quenching the die-blocks, it is important to agitate the quenching bath sufficiently to avoid the formation of gas pockets. If air cooling is employed, the air should be dry and the blast so directed that the air strikes the face of the block uniformly. The series of heat-treatments to be described is applied to cold- and hot-forming die-blocks, and the latter part of the article will cover the heat-treatment of cold-heading dies.

The particular steel or composition to which a given heat-treatment applies will be indicated by giving the die-block number. These numbers correspond to the numbers given in the tables. Table 1 includes five compositions for plain carbon steels.

Table 1. Approximate Chemical Compositions for Carbon Steel Die-blocks

Die-block No.	Application or Type	Carbon	Manganese	Silicon
1	Carbon Steel Die-block. Cold-forming Dies*.....	0.60–0.75	0.20–0.40	0.15–0.30
2	Ordinary Hammer Die-block.....	0.75–0.90	0.20–0.40	0.15–0.30
3	Cold-forming Dies*.....	0.90–1.05	0.20–0.40	0.15–0.30
4	Hot-forming Dies.....	1.05–1.20	0.20–0.40	0.15–0.30
5	Carbon Steel Die-block.	0.50–0.65	0.60–0.80	0.15–0.30

The sulphur and phosphorus content for these steels is 0.030 per cent.
*These steels may or may not contain vanadium up to 0.30 per cent.

Machinery

Normalizing Carbon Steel Die-blocks

In normalizing plain carbon steel die-blocks for cold- and hot-forming, the temperature of the furnace should not exceed 700 degrees F. at the time the die-blocks are inserted. The blocks should be cooled in air until they are below the lower critical point.

Die-block No. 1 (Table 1)—Normalizing temperature, 1475 to 1550 degrees F.; heating time, 1 hour per inch of diameter or thickness. (The smallest dimension of the block should be taken as the thickness in all cases.) Time of holding "at heat," one-fifth of total heating time. If the blocks are large, the time of holding at heat should be increased to refine the center of the block. This applies to all the carbon steel blocks. Air cooling is employed.

Die-block No. 2—Normalizing temperature, 1550 to 1575 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Air-cooled.

Die-blocks Nos. 3 and 4—Normalizing temperature, 1575 to 1650 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Air-cooled.

Die-block No. 5—Normalizing temperature, 1450 to 1500 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Air-cooled.

Annealing and Spheroidizing Carbon Steel Die-blocks

It is assumed that the die-block has been normalized prior to the following heat-treatment, and after this heat-treatment a scleroscope reading should not exceed 30.

Die-block No. 1—Annealing and spheroidizing temperature, 1350 to 1375 degrees F.; heating time, 1 hour for every inch of diameter or thickness plus 1 hour. Time of holding at heat, 1 hour per inch of diameter or thickness. Cool all the blocks slowly in the furnace until they become black. To test the soundness of the steel or its structural condition, the block may be quenched completely after normalizing and spheroidizing; it is then annealed.

Die-blocks Nos. 2, 3, 4 and 5—Annealing and spheroidizing temperature, 1300 to 1350 degrees F.; heating time, 1 hour for every inch of diameter or thickness plus 1 hour. Time of holding at heat, 1 hour per inch of diameter or thickness. Cool in furnace. (See additional information on cooling given for die-block No. 1.)

Hardening Carbon Steel Die-blocks

In hardening a die-block, it is immersed in water to approximately 1 inch below the deepest part of the impression, and held in the water until it has cooled to about 700 degrees F., or slightly below a red heat; it is then quenched entirely in oil. Die-blocks that are approximately a 6-inch cube or smaller may be quenched entirely in water and cooled to about 700 degrees F. They are then withdrawn and cooled in oil to a temperature of about 200 degrees F. and are immediately tempered to the desired hardness. The hardening temperatures and heating periods are as follows:

Die-block No. 1—Hardening temperature, 1450 to 1500 degrees F.; heating time, 1 hour per inch of diameter or thickness, the smallest dimension of the block being taken as the thickness in all cases. Time of holding at heat, one-fifth of total heating time. Quenching medium, water.

Die-block No. 2—Hardening temperature, 1425 to 1475 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, water.

Die-blocks Nos. 3 and 4—Hardening temperature, 1400 to 1450 degrees F. (Note: These heat-treatments do not apply to cold-heading dies.) Heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, water.

Die-block No. 5—Hardening temperature, 1400 to 1425 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, water.

Tempering Carbon Steel Die-blocks

After quenching, the blocks are tempered immediately at a temperature depending upon the hardness desired. For hot-forming die-blocks, a scleroscope reading of 50 to 55 is suggested, the approximate Brinell hardness number being 300 to 325. For cold-forming die-blocks, a scleroscope reading of 70 to 80 is suggested, the approximate Brinell numbers being 425 to 475.

Normalizing Alloy Steel Die-blocks

The approximate chemical compositions of the alloy steel die-blocks to which the following heat-treatments apply are given in Table 2. The temperature of the furnace used for this heat-treatment should not exceed 700 degrees F. at the time the die-blocks are inserted. The blocks should be cooled in the air until they are below the lower critical point.

Die-block No. 6 (Table 2)—Normalizing temperature, 1550 to 1600 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Cool in air.

Die-block No. 7—Normalizing temperature, 1650 to 1675 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Cool in air.

Die-block No. 8—(Note: Die-blocks of this composition are not normalized.)

Die-block No. 9—Normalizing temperature, 1600 to 1650 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Cool in air. (Note: In normalizing this steel, the die-block should not be allowed to become cold. When the temperature has dropped to about 400 degrees F., the block should be placed in the furnace for annealing and spheroidizing.)

Die-blocks Nos. 10 and 11—(Note: These blocks are not normalized.)

Die-block No. 12—Normalizing temperature, 1550 to 1575 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Cool in air.

Annealing and Spheroidizing Alloy Steel Die-blocks

For annealing and spheroidizing, heat to the following temperatures and hold at these heats for the time specified. It is assumed that the die-block has been normalized prior to the following heat-treatment.

Die-block No. 6—Annealing and spheroidizing temperature, 1325 to 1375 degrees F.; heating time, 1 hour per inch of diameter or thickness plus 1 hour. Time of holding at heat, 1 hour per inch of diameter or thickness. Maximum scleroscope reading for this and the following alloy steel die-blocks, 35.

Die-block No. 7—Annealing and spheroidizing temperature, 1350 to 1400 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness plus 1 hour. Time of holding at heat, 1 1/4 hours per inch of diameter or thickness.

Die-block No. 8—Annealing and spheroidizing temperature, 1600 to 1650 degrees F. (Note: This is an annealing operation and the blocks should either be pack-annealed or the bottom of the furnace covered with charcoal. Retard the cooling at 1350 to 1400 degrees F. long enough to produce the proper annealing structure; this applies particularly to the higher carbon ranges.) Heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, 1 hour per inch of diameter or thickness.

Die-block No. 9—Annealing and spheroidizing temperature, 1350 to 1400 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, 1 1/4 hours per inch of diameter or thickness.

Die-blocks Nos. 10 and 11—Annealing and spheroidizing temperature, 1450 to 1500 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, 1 1/4 hours per inch of diameter or thickness.

Die-block No. 12—Annealing and spheroidizing temperature, 1350 to 1400 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, 1 1/4 hours per inch of diameter or thickness.

Hardening Alloy Steel Die-blocks

Die-block No. 6—Hardening temperature, 1500 to 1550 degrees F. (Note: For air quenching, heat

Table 2. Approximate Chemical Compositions for Alloy Steel Die-blocks

Die-block No.	Application or Type	Carbon	Manganese	Chromium	Nickel	Molybdenum	Vanadium	Tungsten
6	Drop-hammer Die-block...	0.50–0.70	0.40–0.80	0.60–1.30	1.00–2.00			
7	Hot-forming Die-block.....	0.60–0.70	0.50–0.80	0.75–1.00	.....	0.60–0.90		
8	Hot Work in General.....	0.30–0.45	0.25–0.35	3.25–3.50	.....	.....	0.30–0.60	9.00–11.00
9	Oil or Air-hardening Die-block	0.50–0.70	0.50–0.80	0.75–1.00	1.00–2.00	0.60–0.90		
10	Hot-working and Shock-resisting Die-block for Drop-forging Small Parts	0.35–0.50	0.20–0.35	0.50–1.50	.....	.....	0.20–0.40	1.50–2.00
11	Hot-pressing Die Steel*...	0.85–1.05	0.15–0.35	3.00–4.50	.....	.....	†	
12	Drop-hammer Die-blocks..	0.50–0.70	0.40–0.80	0.50–1.00	1.00–2.00	0.15–0.30		

Machinery

The silicon content for these steels is 0.15 to 0.30 per cent. The phosphorus and sulphur content is 0.030 per cent, except No. 8, which is 0.020 per cent.
*This steel should not be used where it will be subjected to shocks.
†This steel may or may not contain vanadium.

to 1550 to 1600 degrees F., the following heating period being applied.) Heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, oil having minimum temperature of 100 degrees F. (Note: After quenching the block entirely in oil, it is sometimes customary not to allow the block to reach the temperature of the oil, but to remove it while still hot enough to cause the oil to smoke freely on the surface of the block, but not flash. The smoking hot block is immediately placed in the tempering furnace. This procedure is to prevent breakage).

Die-block No. 7—Hardening temperature, 1575 to 1625 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, oil. (Small blocks—approximately a 6-inch cube or under—should be quenched in oil which has first been heated to 150 degrees F.)

Die-block No. 8—Hardening temperature, 1900 to 2200 degrees F. (Die-blocks made from this steel should be preheated before hardening.) They are heated to 1500 to 1550 degrees F. and held at this temperature for 1 hour for every inch of diameter or thickness; the blocks are then heated quickly to the hardening temperature. The quenching medium is air or oil.

Die-block No. 9—Hardening temperature, 1550 to 1600 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, air. Another treatment for this steel is as follows: Hardening temperature, 1475 to 1525 degrees F.; heating periods, same as just given. Quenching medium, oil. If the block has intricate impressions, it should be pack-hardened and cooled with a blast of dry air, cooling to about 400 degrees F. and tempering at 1000 degrees F.

Die-block No. 10—Hardening temperature, 1600 to 1700 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, one-fifth of heating time. Quenching medium, oil.

Die-block No. 11—Hardening temperature, 1550 to 1700 degrees F. (Note: At high temperatures this steel is susceptible to grain growth, and it is advisable to hold it for a longer time at the lower temperature. If air cooling is employed, preheat to 1500 degrees F. and then heat quickly to 1700 degrees F.) Heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding at heat, one-fifth or total heating time. Quenching medium, either air or oil, depending upon the size of the die-block.

Die-block No. 12—Hardening temperature, 1475 to 1525 degrees F.; heating time, 1 1/4 hours per inch of diameter or thickness. Time of holding heat, one-fifth of total heating time. Quenching medium, oil. (Note: The block may not be allowed to reach the temperature of the oil, but be put into the tempering furnace while smoking hot, as explained for die-block No. 6.)

Tempering Alloy Steel Die-blocks

After quenching, the die-blocks are tempered immediately at a temperature depending upon the hardness desired.

For die-block No. 8, a tempering temperature of 1300 degrees F. for 1 hour is recommended. For die-block No. 9, cool to about 400 degrees F. and temper at 1000 degrees F. For die-block No. 10, the tempering range is 500 to 800 degrees F. For die-block No. 11, temper between 800 and 1000 if oil-hardened, but if air-hardened, the maximum temperature is about 750 degrees F.

The suggested scleroscope readings for some of the blocks are as follows: Die-block No. 6, 50 to 55 (300 to 325 Brinell approximately). Die-block No. 7, 48 to 55 (290 to 325 Brinell). Die-block No. 12, 50 to 55 (300 to 325 Brinell). When air-cooled die-blocks are not tempered, the desired scleroscope reading is 42 to 48, the approximate Brinell numbers being 260 to 290. Before using a die of analysis No. 8 (Table 2), it should first be heated to approximately 200 degrees F.

Heat-treatment of Cold-heading Dies

The following heat-treatments for cold-heading dies apply to steel of approximately the following composition: Carbon, 0.90 to 1.05; manganese, 0.20 to 0.40; silicon, 0.15 to 0.30; phosphorus, 0.030; sulphur, 0.030.

Normalizing—Temperature, 1575 to 1650 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Cooling medium, air.

Annealing and Spheroidizing—(It is assumed that the die-block has been normalized prior to this heat-treatment.) Temperature, 1300 to 1350 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, 1 hour per inch of diameter or thickness. Cool in the furnace. (After this heat-treatment, the scleroscope reading should not exceed 30.)

Hardening—The blocks should be preheated to 1400 degrees F. before hardening. This steel is purposely overheated to develop a coarse grain structure which has been found to give the best results for most classes of cold-heading dies. Hardening temperature, 1650 degrees F.; heating time, 1 hour per inch of diameter or thickness. Time of holding at heat, one-fifth of total heating time. Quenching medium, water and oil. The die should be removed from the bath when cooled to about 700 or 800 degrees F.; the cooling is then completed in oil.

Tempering—After quenching, the dies are tempered immediately at a temperature of 500 to 600 degrees F.

* * *

THE RUSSIAN METAL-WORKING INDUSTRY

According to an announcement made by the Amtorg Trading Corporation, 165 Broadway, New York City, plans are now made for the erection in Russia during the next five years of a number of modern, up-to-date plants in the different metal-working fields involving an expenditure of $300,000,000. The construction of a new tractor plant at Stalingrad to have a yearly output of 10,000 tractors is now under way and that machinery valued at $6,000,000 is to be purchased for this plant. During the current year about $120,000,000, it is stated, will be spent on construction work in the industries.

Drilling and Pin Assembling Fixtures

By B. J. STERN

THE accompanying illustrations show equipment employed for drilling a blind hole at *X* in the brass casting *W*, shown by heavy dot-and-dash lines in Fig. 1, and for forcing a pin *Y*, Fig. 3, into the drilled hole. The brass casting is a part of a water appliance that must be water-tight when subjected to a high-pressure test. A gear train unit is assembled in the upper part of the casting, the small pin *Y*, which is 0.070 inch in diameter, being used for locating this unit.

It is necessary to drill a blind hole in the inside of the casting in the proper location, and then force the small locating pin into the drilled hole. It would seem easier to drill the hole from the outside of the casting, force the pin into place, and then plug up the hole at the back of the pin. This procedure, however, is not permissible, as plugs inserted in this manner have proved leaky and have even been forced out under the severe pressure tests applied.

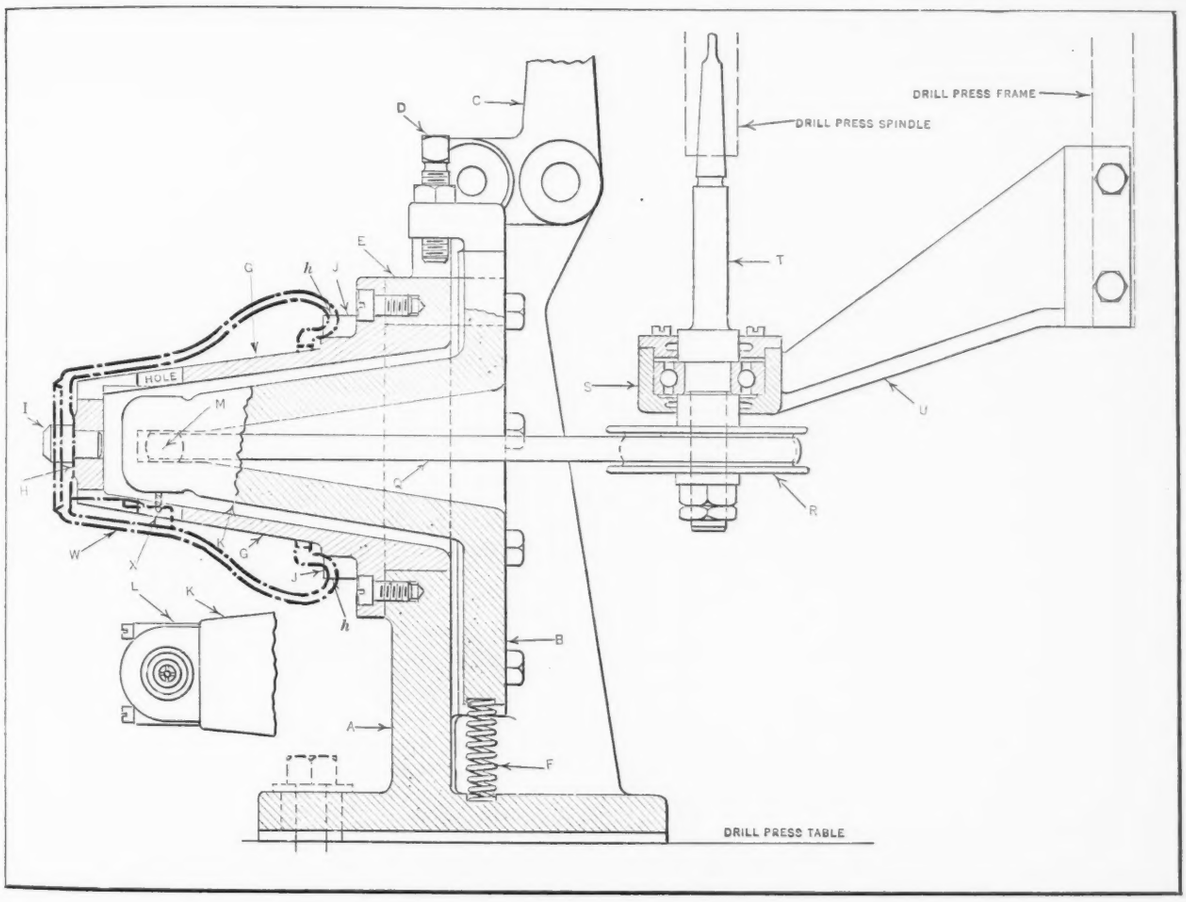


Fig. 1. Fixture for Drilling Blind Hole in Casting

The drilling fixture shown in Fig. 1 is mounted on the table of the drilling machine, the angle-plate casting *A* being clamped to the table. Casting *B* moves up and down in the slide in angle-plate *A*, being actuated by the handle *C*. An adjustable stud *D* in the slide *B* strikes the hardened plug *E* in the angle-piece and limits the distance that the slide moves downward, while the spring *F* serves to bring the slide back. Fastened to the front of the angle-plate is a hollow steel cone *G*, which is used for locating the work as indicated in the illustration.

The work is placed over this cone and pushed forward until the finished surface *H* strikes the front of the cone block, while the plug *I* locates the finished center hole in this surface. Simultaneously, the finished hole *h* in the front of the work slides over the hardened and ground ring *J* at the bottom of the cone. The hole has to be drilled in one of four equally spaced ribs in the interior of the work, and to make sure that this hole is drilled in the right place, a stop (not shown in the illustration) is so arranged as to catch the rib opposite the one to be drilled. The work is thus properly located in every respect.

Projecting into the interior of the hollow locating cone *G* is the extension *K* of the slide *B*, which is cored out as shown. On the top of this projection is mounted the spindle bearing assembly *L*, a section of which is also shown in Fig. 2. The spindle *M* of this assembly runs in ball bearings and is

bored out to receive the split spring chuck *N* which is forced back against the taper in the spindle by the nut *O*. A drill is clamped in the split chuck by the action of this nut, which is reached through a hole in the cone *G*, Fig. 1, the position of the drill being determined by the set-screw *P*, Fig. 2, which is adjusted through the same hole.

The spindle *M* also serves as a pulley, as can be seen in the illustration, and a narrow leather belt *Q* is wrapped around it, passing through the core in the slide projection *K* to encircle the pulley *R*, Fig. 1, of the driving assembly *S*. This ball-bearing driving unit is held in the casting *U*, which is attached to the frame of the drill press. The shaft *T*, which drives the pulley *R*, is tapered at the end to fit the drill press spindle.

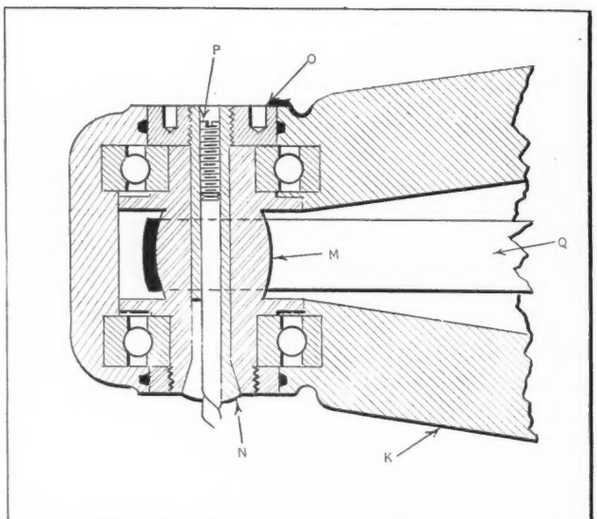


Fig. 2. Spindle Assembly of Drilling Fixture Shown in Fig. 1

The action of this fixture will be evident from the illustration. The operator slips a brass casting over the locating plugs *I* and *J* until the finished surface *H* strikes the face of the cone *G* and one of the interior ribs is caught by the stop. Holding the casting in place with one hand, the operator pulls down handle *C* with the other hand, causing slide *B* to carry the drill down until stop *D* strikes plate *E*. The drill is in constant rotation, being driven by the pulley *R* which, in turn, is driven by the drill press spindle.

When the drilling is completed, the handle is released and the slide returns to its original position, bringing the drill up out of the way, so that the work can be slipped off and another casting substituted. As the drill travels down but a short distance, it is not necessary to make the driving unit *S* movable in a vertical plane, the belt adjusting itself sufficiently to take care of the movement of the drill.

It is now necessary to drive a pin into the hole drilled by the method described. This is accomplished in the fixture shown in Fig. 3, which is mounted on a small bench at the side of the drill press. The fixture consists primarily of a base *A*, which is cored out as shown and is clamped to the bench. The casting projects into a cone member, which is made small enough to readily enter the work casting. Fastened to the front of casting *A* is a steel block *B*, which contains the hardened and ground slide *C*; this slide is actuated by the rounded head of lever *D* which is fulcrumed at *E* in block *B*.

To the end of lever *D* is pinned a steel block *K*. A stud *F* is screwed into block *K* and a chain leading to a foot-treadle is attached to the stud, so that when the operator pushes down on the treadle, he causes the lever to force slide *C* up. On the top of the slide is a nest for the brass pin to be assembled.

The work is then placed over the block *B* until plug *G* locates itself in the part and the finished surface *H* strikes against block *B*. At the same time, the inner rib in which the hole has been drilled is caught between the projecting ends of the hardened stop *J*.

The work is thus located, and the operator, depressing the foot-treadle, forces up the slide *C* which contains the pin, driving the well chamfered pin into the drilled hole. Slide *C*, striking the rib in the part, determines the distance the pin will project from the rib.

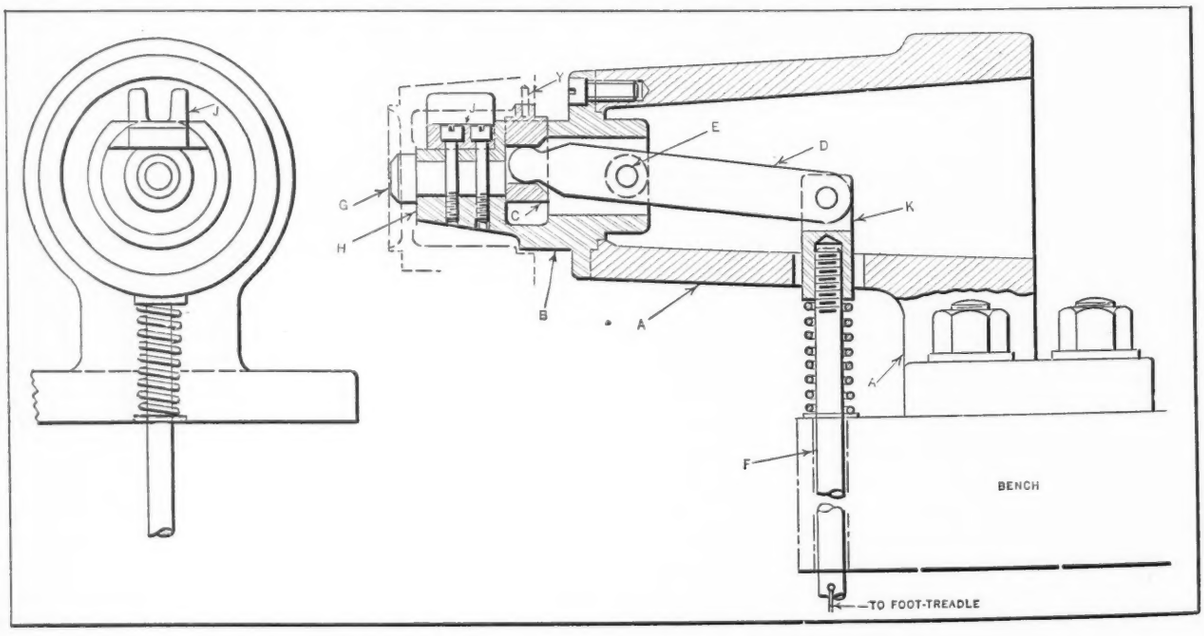


Fig. 3. Fixture for Forcing Pin into Blind Hole

What MACHINERY'S Readers Think

Contributions of General Interest are Solicited and Paid for

IS PRODUCTION THE ONLY THING?

I had the opportunity not long ago of witnessing an example of a serious manifestation of what I would call the "production complex." While talking to the superintendent of a plant, a machine shop foreman approached, stating that Bill Tompkins, the operator of the vertical boring mill, had met with a serious accident and had to be taken to the doctor's office immediately. Without any evidence of feeling or concern for the injured workman, the superintendent inquired "Is that going to hold up those brackets?" The man's welfare was apparently a secondary matter, the brackets were the uppermost thing.

Such cases, I hope, are very rare, but as there is a tendency in some places toward the development of a conception that production is the primary thing and human welfare secondary, I wanted to record this experience. We want production, because it is production that has improved the standard of living and the well-being of our people, but we do not want production at the expense of ordinary humane considerations.

JOHN HOMEWOOD

SCRAPPED WORK

Many methods have been tried out for preventing excessive losses in machine shop production due to spoiled work, but the writer does not believe that any flawless scheme to prevent these losses has ever been found. The loss due to spoiled work reaches a high figure yearly. Four contributing causes, in the order of their importance, are inefficiency, inability, carelessness, and accidents.

Inefficiency—Inefficiency covers a multitude of causes, such as defective or over-complicated blueprints, misunderstood or wrong orders, etc. The fault may be anybody's—from the general manager down to the individual workman. Placing the burden is sometimes a serious proposition. Charging it back against the workman is sure to cause trouble. Immediately there would be noted a change of atmosphere in the entire plant, dissatisfaction, lack of cooperation, and a general loss of interest.

Inability—Inability does not necessarily mean that a workman is incompetent. Many times a man is given work that is far too difficult for him, while he may be a very valuable man on other jobs. Place men where they can do their best work. A good planer hand, who has never done anything else, may not be able to do fine grinding work that calls for sensitive measuring with micrometers and verniers.

Carelessness—Carelessness is easily proved, and should not be tolerated. A careless man is not wanted in any shop.

Accidents—Accidental losses are due to failure of machines, feeds, clamps, breakage from flaws in materials, and numerous other causes. If all concerned have been reasonably careful and observant, these accidents are unavoidable and no one is to blame.

We have tried several methods of preventing losses due to the foregoing causes, and find the most successful one for us is to appeal to the workman's pride. No one likes to be pointed out as a defective link in a chain of men, and anyone who is not affected by the "pride appeal" comes under the heading of "careless."

The appeal to the workman's pride is made by posting typewritten reports every two weeks on a board, such as is used for shop notices. Two sheets are used, one for honorable mention, containing the names of every man in the place who has had no trouble of any kind for two weeks, and the other, which may be called the black list, giving the names of men who have been guilty of various offences, such as spoiled work, lateness, fighting, etc. The intense interest this board produces is surprising, and the anticipation of the next report holds the interest of the men.

An inflexible set of rules must apply to this efficiency board. Some of the rules that we have made are as follows: *Rule 1*—Any man whose name appears on the black list twice in succession for spoiled work is ineligible for pay increases for twelve months. *Rule 2*—Any man whose name appears three times in succession, will have his hourly rate reduced in proportion to the value of the losses he has caused. *Rule 3*—Any man whose name appears four times in succession, for the same offence, will be discharged.

RAYMOND H. DAUTERICH

FORETHOUGHT AS A SAFETY FACTOR

Experience is one of man's chief educators, but very often is a hard taskmaster. Much of the knowledge we have acquired has been doled out to us by this too often unrelenting teacher. Probably it is well that it is so, as many of the lessons thus learned make a lasting impression.

The human element is the most difficult factor in the safety problem of shop management. We are prone to criticize the actions of others, but too frequently fail in a proper analysis of our own accomplishments. A common cause of accident is the impulsiveness of the workman, this trait being particularly pronounced in young apprentices and inexperienced mechanics. When seconds count, it is necessary to think quickly—but doubly important to think and act right.

The automatic and semi-automatic character of present-day metal-working tools has left undeveloped much of that reasoning power that in former years was highly developed in the average workman. Apprentices and older mechanics should endeavor to cultivate the habit of speedy but accurate forethought in the discharge of their duties,

as a mental review of possible developments will often forestall injury to the operator or machine.

Before starting on a new job—large or small—survey, mentally, the possibilities for accident. Cultivate the habit of forethought. Always have your mind a little in advance of your work, guiding and directing the movements of hands and feet, so that the body as a whole will be in readiness to act quickly under any and all circumstances. Accidents will happen, but an ounce of mental preparedness will often prevent them.

JAMES H. RODGERS

SELECTING TRADE NAMES AND FIRM NAMES

The writer has sometimes found it difficult to locate the builder of a certain machine or device by the trade name. Often, there is no connection between the trade name and the name of the builder, and only by referring to some very complete list of trade names has it been found possible to locate the manufacturer. It seems to the writer that many manufacturers would derive greater benefit from the use of trade names if greater care were taken in selecting them.

It is exceedingly difficult to select a good trade name, but, if possible, there should be some tie-up between the trade name and the name of the concern manufacturing the machine or device. It would seem that the greatest value might be derived from the name of a machine or tool if it were identified with the name of the city or town in which it is built or with the company making it. Two well-known milling machines, for example, are instantly identified by the name of the cities in which they are built.

As an exact opposite to selecting trade names in this commendable way, the writer has found a few examples where a company building machine tools in one town bears a name that incorporates that of another city. This causes a great deal of confusion, but there are a few instances of it in the machine tool building field. Using fictitious names, if we hear of the Hartford Machine Tool Co., we naturally would expect it to be located in Hartford, Conn., and not in Pittsfield, Mass.; and yet, there are cases of names of manufacturing plants selected in that manner. OBSERVER

INVESTING IN SALESMEN'S GOOD WILL

From time to time articles have appeared in MACHINERY relating to courtesy to salesmen. It is gratifying to record that the number of shops is increasing where a friendly notice is posted in the reception room telling salesmen that it is the policy of the firm that they be attended to promptly, and that if they are kept waiting for any length of time—usually ten minutes—they are expected to call this to the attention of the attendant or telephone operator, so that the oversight may be corrected.

More and more firms are recognizing the value of the information that they receive from the present-day mechanically well-informed machinery and tool salesman. This information, in many instances, has helped the firms to obtain up-to-date information which enables them to reduce their costs and hold their own in highly competitive fields. One sales executive recently called the writer's attention to the fact that two automobile concerns that have held their own ever since the early days of the automobile, in competition with much larger concerns, have a reputation for dealing courteously and fairly with salesmen; while two other concerns in the same field that have disappeared from the list of automobile builders were generally known as unusually lacking in courtesy and fairness in their dealings with the representatives of manufacturers and their salesmen.

It may be thought that there is no very close connection between the way a firm deals with men that sell equipment to them and their success in business, but when the salesman is in a position to furnish so much information as to the best and latest practice, and is able to give such definite service as he can in the machinery field, his good will is well worth cultivating. DETROITER

BUSINESS AS A NATIONAL ASSET

Secretary Hoover has served this nation well in many respects—in none, perhaps, better than by the broad view of business that he has endeavored to make business leaders see and adopt. He has pointed out that we have reached a stage of such complex national development and that businesses now depend on each other to such an extent that we must have a national planning of industry and commerce if we are to avoid the frequent setbacks to business due to some one industry putting a spoke in the wheels of the business machine.

More cooperation within specific industries and between different industries is required. Secretary Hoover has aided us in recognizing that an individual business alone cannot be prosperous unless the entire business structure of the country is sound and prosperous. He believes that this cooperative work should be done on the initiative and through the efforts of business itself. He points out that where, in this country, the Government has interfered with business, it has been largely in instances where business has been unable to maintain the business machine in smooth running order without some public pressure.

Some time ago, in an address, Secretary Hoover said: "Our goal in economic life is to preserve individual initiative and equality of opportunity, thereby promoting a constantly advancing national standard of living. Our economic and social system is fundamentally right. It has produced the largest advance in the standard of living to the whole of our people that has ever been witnessed in history. Its faults are many, but they can be, and are being, corrected without destroying progress."

It is gratifying to note that there is more cooperation in business today than there has ever been in the past. Not only do manufacturers making similar lines of product get together with a view to eliminating waste and trade abuses, but there is a greater tendency toward cooperation between different industries and an understanding of the fact that the prosperity of one industry is impossible unless all others prosper as well.

N. ROBERTS

CANVAS BELT DRIVES—1

This table is based upon an arc of contact of 165 degrees, and has been corrected for centrifugal force—compiled by Allied Belting Co.

Pulley Diameter in Inches × R.P.M.	Belt Speed, Feet Per Min.	Horsepower Transmitted by a Belt 1 Inch Wide				
		4-Ply	5-Ply	6-Ply	8-Ply	10-Ply
764	200	0.36	0.45	0.54	0.72	0.72
1528	400	0.72	0.90	1.08	1.26	1.44
2292	600	1.08	1.35	1.62	1.89	2.16
3056	800	1.44	1.80	2.16	2.52	2.86
3820	1000	1.80	2.25	2.70	3.15	3.60
4584	1200	2.16	2.70	3.24	3.78	4.32
5348	1400	2.52	3.15	3.78	4.41	5.04
6112	1600	2.88	3.60	4.32	5.04	5.76
6876	1800	3.24	4.05	4.86	5.67	6.48
7640	2000	3.60	4.50	5.40	6.30	7.20
8404	2200	3.94	4.93	5.92	6.82	7.88
9168	2400	4.26	5.32	6.38	7.46	8.52
9932	2600	4.56	5.70	6.84	7.98	9.12
10696	2800	4.86	6.08	7.29	8.50	9.72
11460	3000	5.15	6.44	7.73	9.02	10.30
12224	3200	5.42	6.78	8.12	9.50	10.84
12988	3400	5.67	7.08	8.50	9.92	11.34
13752	3600	5.90	7.38	8.86	10.33	11.80
14516	3800	6.11	7.64	9.16	10.68	12.22
15280	4000	6.29	7.86	9.43	11.00	12.58
16044	4200	6.46	8.07	9.69	11.30	12.92
16808	4400	6.60	8.26	9.91	11.55	13.20
17572	4600	6.73	8.42	10.10	11.77	13.46
18336	4800	6.83	8.54	10.25	11.95	13.66
19100	5000	6.92	8.65	10.38	12.11	13.84
19864	5200	7.00	8.75	10.50	12.24	14.00
20628	5400	7.06	8.83	10.59	12.35	14.12
21392	5600	7.11	8.89	10.66	12.44	14.22
22156	5800	7.14	8.92	10.71	12.49	14.28
22920	6000	7.15	8.94	10.72	12.51	14.30

To determine the horsepower transmitting capacity of a canvas belt, multiply the pulley diameter in inches by its speed in revolutions per minute and select the nearest corresponding value in the first column of the table. Then find in the table the horsepower corresponding to this value and to the ply number and multiply the horsepower thus found by the width of the belt in inches. The result will be the number of horsepower that will safely be transmitted by the belt under normal working conditions.

MACHINERY'S Data Sheet No. 113, New Series, September, 1927 Contributed by J. C. Patty

CANVAS BELT DRIVES—2

PULLEY DIAMETERS FOR GIVEN BELT SPEED AND PLY NUMBER

There should be a definite relation between the thickness of a belt and the pulley diameter. Resistance to bending increases approximately with the square of the belt thickness. If a pulley is too small for a given thickness, the outer part of the belt will be subjected to excessive tension as it passes around the pulley, causing "buckling" or piping on the inner face next to the pulley. There is also waste of power in bending a thick belt around a small pulley, and belt slippage is more likely to occur. These tendencies are all increased with the belt speed; hence, pulley diameters should be increased not only with belt thickness but also with the speed. The following table gives both the minimum pulley diameters for use under special conditions, and also those diameters representing good practice (columns headed G. P.).

Belt Speeds, Feet per Minute	4-ply		5-ply		6-ply		8-ply		10-ply	
	Pulley Diameters, Inches									
	Min.	G. P.	Min.	G. P.	Min.	G. P.	Min.	G. P.	Min.	G. P.
500	4	6	6	8	8	10	..	..	..	..
1000	5	7	7	10	10	14	20	30	..	..
2000	6	8	8	12	12	16	24	36	36	48
3000	7	9	9	12	14	18	28	40	42	54
4000	8	10	10	16	16	22	32	44	48	60
5000	..	..	12	18	18	26	36	50	54	66

APPROVED CENTER DISTANCES FOR PULLEYS

A belt should be long enough to absorb, by its elasticity, slight variations in the speed of both driving and driven pulleys. This condition is obtained by adhering to the following distances between pulley centers.

Belts up to 6 inches wide, 12 to 15 feet between pulley centers

Belts 6 inches to 12 inches wide, 15 to 20 feet between pulley centers

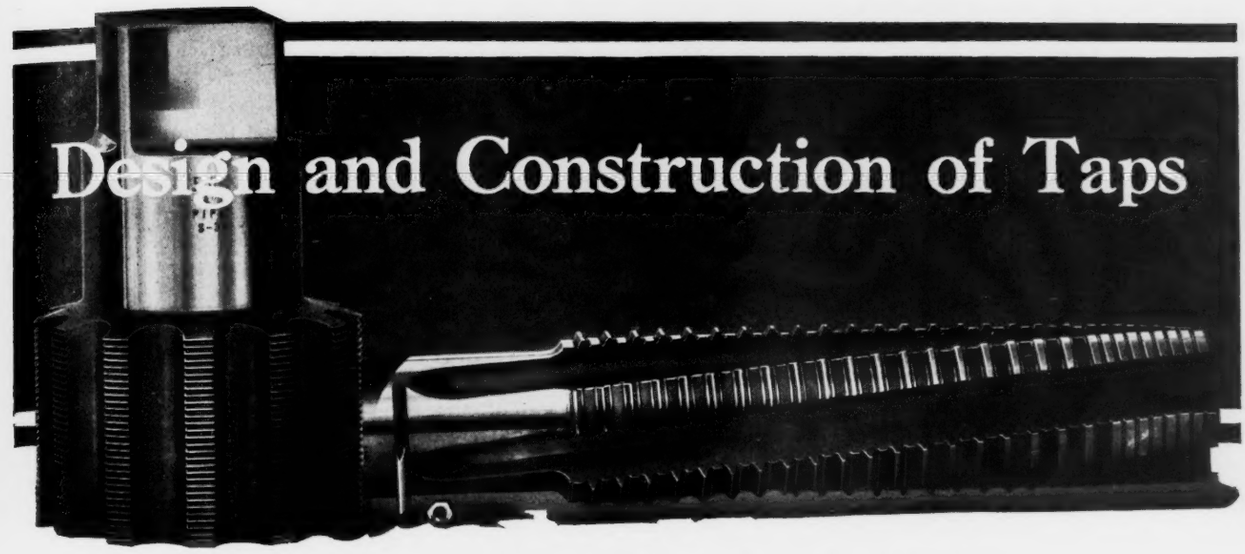
Belts 12 inches to 24 inches wide, 20 to 25 feet between pulley centers

Belts 24 inches to 36 inches wide, 25 to 30 feet between pulley centers

Belts over 36 inches wide, 30 to 40 feet between pulley centers

For large main drives and heavy countershaft or motor drives, the distance between pulley centers should not be less than is required for an arc of contact of 165 degrees on the smaller pulley. This condition will be approximated closely by the use of the following rule: To find the *minimum* distance between pulley centers, divide the difference, in inches, between pulley diameters by 3. The result is the distance between centers, in feet.

MACHINERY'S Data Sheet No. 114, New Series, September, 1927 Contributed by J. C. Patty



Design and Construction of Taps

Acme and Square Thread Taps in Sets—Staybolt Taps

By A. L. VALENTINE, Manager, Tap and Gage Division, SKF Industries, Gothenburg, Sweden

IN the five installments of this series of articles previously published, inaccuracies frequently found in taps that are not ground in the thread after hardening have been discussed, and the reasons for the development of ground taps have been given. Tolerances, forms of flutes, relief, over-size dimensions on the diameters of taps, back taper, and hand taps made in sets have been discussed. The present article will deal with Acme-thread taps, square-thread taps, staybolt taps, and taper-threaded taps.

Acme Thread Taps

The use of spiral-fluted ground taps has practically revolutionized the results obtained in tapping Acme-thread nuts. In the past, it was practically impossible to obtain a correct Acme thread-form in a nut, partly on account of the steep angles on the sides of the thread and partly because of the generally quick lead and great depth of the thread, relative to the diameter. In many instances, therefore, such threads were cut entirely in a lathe with a single-point tool, or, after having been rough-threaded in this manner, were finish-threaded with a so-called master tap, which would then produce, if not absolute accuracy, at least interchangeability between the threaded holes. Both of these methods are expensive and do not produce the most accurate results.

With spiral-fluted ground Acme taps having a correct amount of relief, it is possible to produce Acme nuts of any material that are correct within any commercial limits. It is evident that spiral flutes are of the greatest importance, if not absolutely necessary, in this case, because the lead of the thread is generally very steep and the thread depth very great, relative to the diameter. The good results obtained with taps of present-day con-

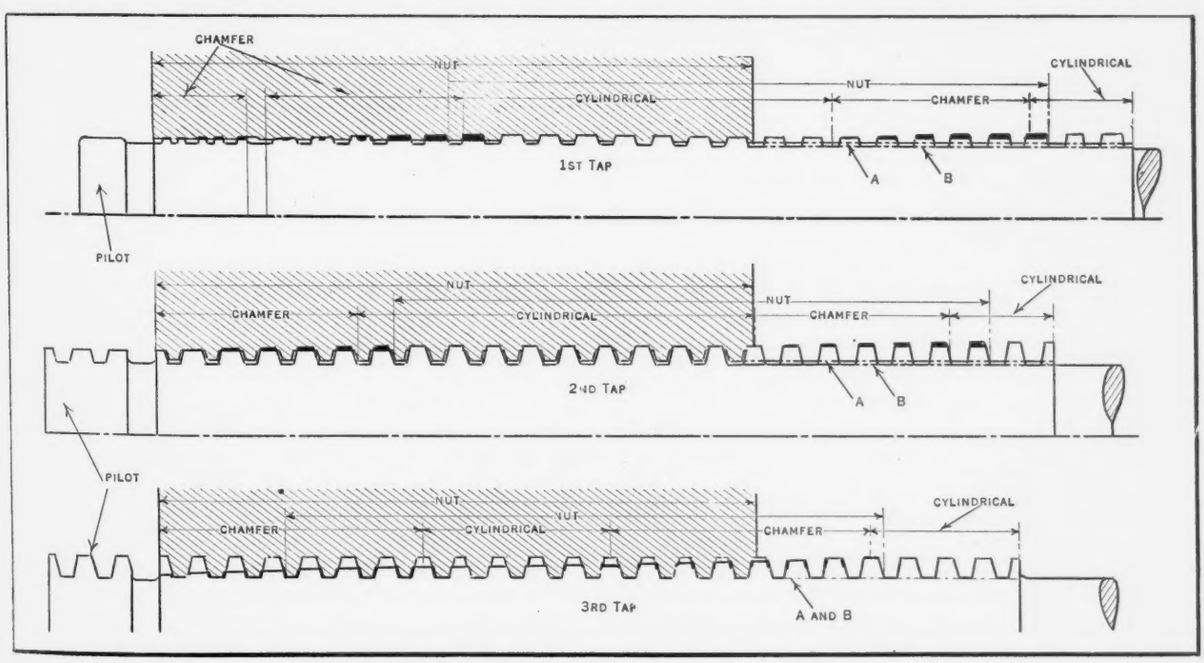


Fig. 1. Design of Acme-thread Taps in Sets

struction are, however, not wholly due to the spiral flutes, but also to a great extent to other features in the design.

The work should be divided between one or more roughing taps and a finishing tap, the number of roughing taps depending upon the length of the nut to be tapped, the diameter, and the lead. The last roughing tap nearly finishes the outside diameter of the thread, but leaves the thread spaces in the nut smaller than they should be in the finished thread; the finishing tap then completes the angular sides of the thread and shaves the outside.

Design of Acme Taps

The design of Acme taps is shown in Figs. 1 and 2, in which the amount of work performed by each cylindrical threaded section is about equal to the length of the thread in the nut. Hence, when the first chamfered portion begins to protrude from the hole, the next chamfered portion begins to cut. The length of each chamfered section, however, is never made more than twice the outside diameter of the thread; this rule should be further modified by the statement that the chamfered part should never be over 2 inches long.

Referring to Fig. 1, *A* shows the root diameter of the nut, and *B* the root diameter of the taps. In the third tap in the set, the root diameter of the nut and the tap are alike; hence, *A* and *B* are the same. The sections of the thread cut away by each portion of the taps are shown by the solid black areas and the heavy lines.

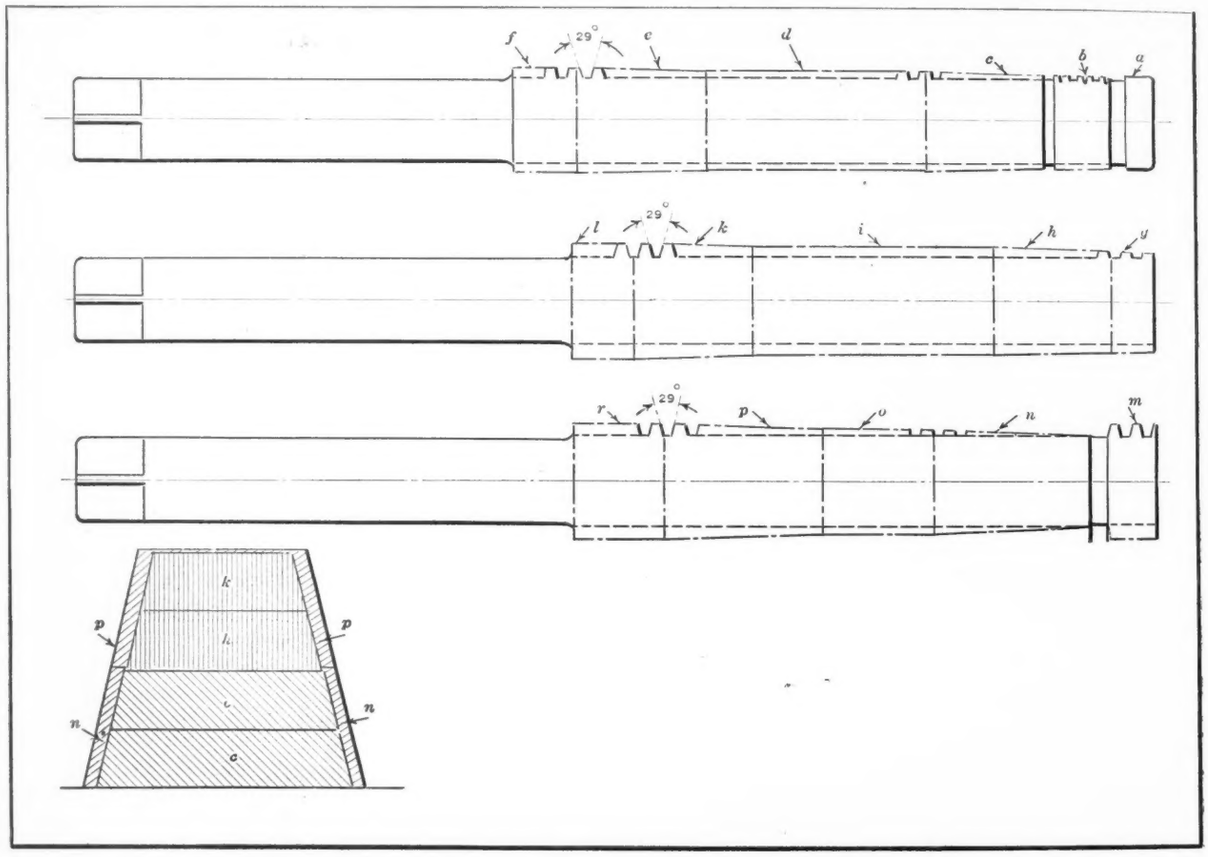


Fig. 2. A Set of Acme-thread Taps, Showing Work Done by Each Tap

tap in a set is also indicated. The first roughing tap is provided with a pilot, the diameter of which is equal to the diameter of the hole to be tapped. Next to the pilot is a short threaded and chamfered portion, the function of which is to take hold abruptly in the hole and thus force the tap forward according to the correct lead without reaming the hole. The tops of the threads of this pilot are split in order to reduce the broad thread surface, so that the tap will more easily secure a hold in the hole.

Each tap consists of two chamfered parts separated by a cylindrical section which does not cut. The reason for this construction is that Acme nuts are usually comparatively long, and, therefore, the work of the tap would be too great if it were to cut with the whole length of its thread at once. The lengths of the respective threaded portions are, therefore, made so that the length of the first chamfered portion plus the length of the following

As an example, assume that an Acme nut, 3 inches long with a thread 1 inch in diameter, 6 threads per inch, is to be tapped. The first chamfer would be made 1 1/4 inches long; the adjoining cylindrical part would be 1 3/4 inches long (3 — 1 1/4 = 1 3/4). The second chamfered part would also be made 1 1/4 inches long, this being followed by a cylindrical threaded part about 1 inch long. It is not necessary to make the second cylindrical portion any longer. It is evident that with this construction there can never be more than a 1 1/4-inch length of chamfer cutting at one time.

The threaded pilot on the second tap is made slightly smaller in diameter than the last cylindrical portion of the first tap; the same is the case with the pilot on the third tap, as compared with the second, etc.

Ground Acme-thread taps with spiral flutes constructed in this manner give good results in tap-

ping all kinds of materials, care being taken to see that the rake of the cutting edges is suitable for the material to be tapped. The number of taps needed in a set depends chiefly on the length of the nut, the lead on the thread, and the material to be tapped. When tapping cast iron with a tap of large dimensions, each tooth can easily cut a chip 0.005 inch thick. If the tap is smaller, or has a coarse lead, or weak threads, each tooth must cut less. In bronze, which is usually tough, each tooth cannot generally cut more than in ordinary steel, or about 0.003 inch. In the case of one tap with two chamfered portions, or in a set of two taps with only one chamfered portion each, a good rule to follow is that the roughing tap should cut away two-thirds of the cubic contents of the chips to be removed, and the finishing tap one-third.

Relief and Chip Space of Acme Taps

The relief of Acme taps should vary with the diameter of the tap and with the material to be tapped. A 1 1/4-inch tap is generally relieved about 0.006 inch in the pitch diameter, 0.003 inch on the outside diameter, and 0.010 inch on the outside diameter of the chamfered portion. If the nut material is tough, sticky, and stringy, so that it has a tendency to attach itself to the threads of the tap, the relief should be increased. The chip or flute space is of great importance. The longer the nut and the more each tooth cuts, the more chip space is necessary. If sufficient chip space cannot be obtained with one tap except by unduly reducing its strength, it is, of course, necessary to use two taps, and if this is not sufficient, three, and so on.

Square-thread Taps

One of the most difficult problems that the tap manufacturer is called upon to solve is to design and make square-thread taps. Ground square-thread taps with spiral flutes have, however, solved this hitherto practically unsolved tapping problem. The work of each tap and of each chamfered part of a tap is divided according to the same principles as outlined for Acme taps.

The roughing taps are not made with a square thread form, but the thread has an included angle

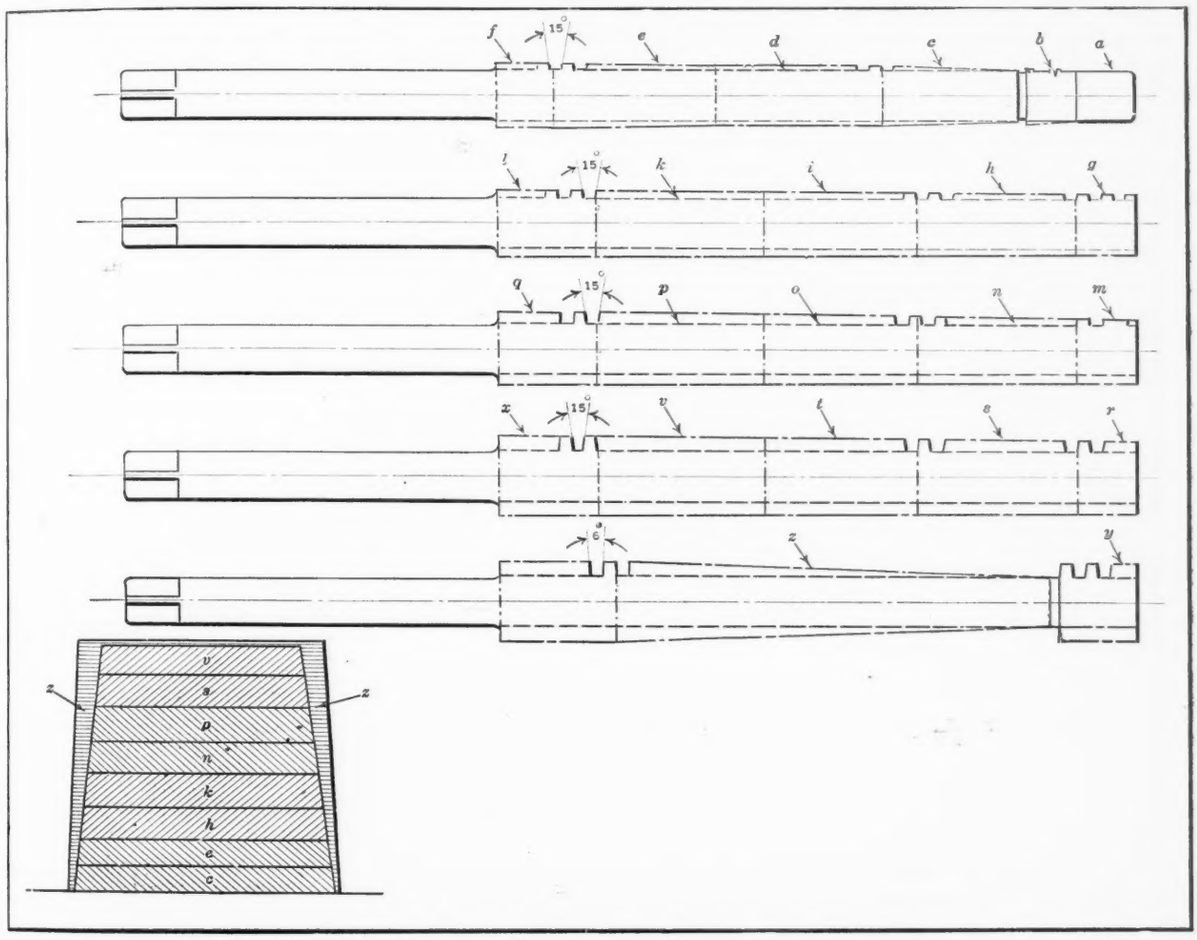


Fig. 3. A Set of Square-thread Taps, Showing Work Done by Each Tap

of from 14 to 20 degrees, so that the sides of the tap threads may be relieved. This, of course, would not be possible if the sides of the thread were at right angles to the axis of the tap. The finishing tap is generally made with an included angle of from 2 to 4 degrees, depending upon the lead angle. This slight angle is generally permissible, as it is impossible to mill or grind a square thread correctly with a milling cutter or disk grinding wheel. On the other hand, it is possible with such slight angles to provide the thread sides with a small amount of relief, which otherwise could not be done.

The fact that square threads cannot be relieved is the reason for the difficulties arising in the use of these taps. The slightest dullness or rounding over of the teeth prevents the tap from cutting, and it merely wedges itself into the nut material, fin-

ally sticking and breaking. As soon as the dullness or rounding over of the teeth is as great as the chip thickness (and owing to the weak section, the chip thickness is very small, as each tooth can cut only a relatively small chip) the tap will no longer cut, and will frequently break. Hence, it is important that the cutting edges be sharpened before they have dulled or rounded over an amount greater than the chip thickness.

The roughing taps, with from 14 to 20 degrees included angle, can be provided with any amount of necessary relief on the sides, and a finishing tap, with from 2 to 4 degrees included thread angle, can also be given a slight amount of relief. It is very important that square as well as Acme thread taps be ground with a slight back taper to prevent the nut material from sticking to the thread surface in the tap.

Fig. 3 shows an unusual set of square-thread taps; the division of the work between the different taps, and the different portions of the taps in a set, are clearly shown in the sectional view. Assume that the length of the nut is 3 inches and the diameter of the thread 7/8 inch, with 1/4 inch pitch and 1/2 inch lead. This produces a very weak root and shank diameter and makes tapping very difficult. A set of five taps, constructed as shown in the illustration and ground in the thread, but having straight flutes and, for that reason, less relief, could not do the work successfully. With spiral flutes, these taps, ground in the thread, did the work easily; in fact, only four taps in a set were afterward found sufficient for the nut material to be threaded.

Design of Staybolt Taps

In Fig. 4 are shown a number of different types of staybolt taps which have been successfully ground in the thread. It is evident that the advantages obtained in ordinary ground taps are still more accentuated in a staybolt tap. This type of tap is generally made with straight flutes, because the lead of the thread is small compared with the diameter. The flutes are usually odd in number—three or five—on account of the fact that these taps work most successfully in boiler plate or copper only when the thread is cut away successively in alternate lands, and a continuous thread is then possible only with an odd number of flutes. When the tooth in every other land is cut away, the chips break more easily, more chip room is obtained, and the lubricant becomes more effective.

The cutting away of the thread on every other land in these taps is, if not absolutely necessary, at least very important, especially for European boiler materials, which are tougher than those generally used in America. In fact, the author's experience has been that torn threads can hardly ever be avoided on boiler materials, such as are used in France, England, and the Scandinavian countries, unless the staybolt taps have the alternate teeth cut away.

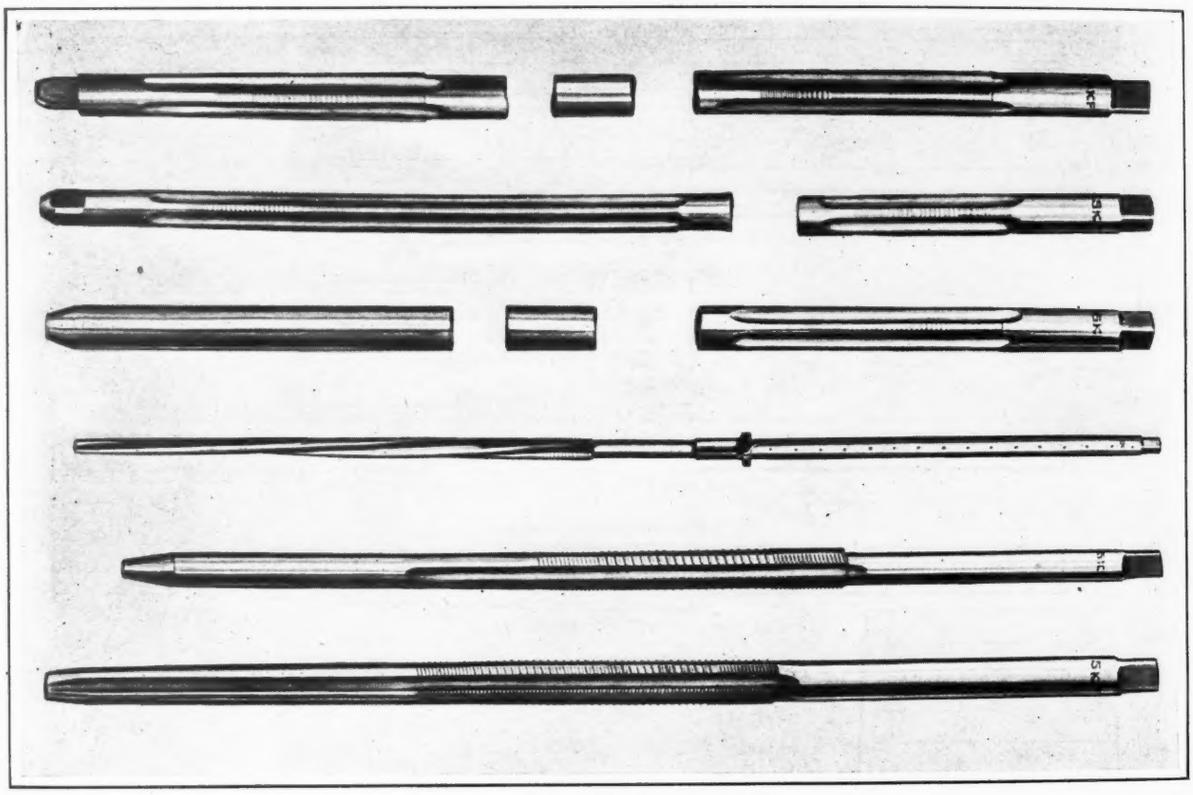


Fig. 4. A Collection of Staybolt Taps

Staybolt taps with ground threads have been made 1 1/2 inches in diameter and 89 inches long, with threaded portions at both ends, there being a distance of 64 inches between the two threaded parts. The accuracy in the lead of these taps is guaranteed to be 0.0001 inch per inch, so that the lead error between the two threaded parts will not exceed 0.0064 inch. It is evident that when such a long tool is used, the temperature should be about the same as when it was finish-ground.

In Fig. 4 is also shown a spiral-fluted staybolt tap having a total length of over 60 inches. On the shank of this tap are several spots into which fits the point of a screw mounted in a threaded bush-

ing, which slides freely on the shank of the tap. The diameter, pitch, and form of thread on this bushing are the same as those of the tap, and the lead of the bushing, when held at any one of the spots on the shank of the tap, is continuous with the lead of the tap.

Taper-threaded Taps

Taper-threaded taps, such as pipe taps, patch bolt taps, boiler taps, wash-out taps, etc., are not satisfactory if relieved too much. When such a tap with too much relief is backed out of a hole, the threads must slide over the chips left by the tap, and this backing out over the chips, in tough materials particularly, causes the front of the cutting edges of the tap to break. If, on the other hand, the tap has only just enough relief so that it will clear when backing out, the protruding chips will be sheared off by the back of the lands (the back part of the flutes of these taps being radial), and there will not be sufficient chips left in the hole to cause any damage to the cutting edges of the tap when it is reversed.

The Increasing Use of Ground Taps

Ever since ground taps were introduced, good results have been obtained with them. Increased precision, longer life—making possible a substantial increase in the number of holes tapped—and the ease with which the taps work (reducing power consumption) are the factors that have appealed to the users of taps who carefully investigate results before buying. It is safe to state that although at present the first cost of these taps is higher, they are cheaper than unground taps when the work performed by them is considered. In other words, the cost per tapped hole is less. Furthermore, the author believes that in a comparatively short time ground taps will be manufactured and sold at the same price as unground taps. This belief is based on the fact that the methods of manufacturing ground taps are still in their infancy, and that the highest developments in machines, grinding appliances, and grinding wheels are still in the experimental stage.

The selection of the right material for the taps and the heat-treatment have more effect on the cost of ground taps than on those that are not ground. The material and the heat-treatment that produce the least change in the lead of the tap while maintaining its cutting qualities will produce the cheapest ground-thread tap, because if the lead is nearly correct and the tap is straight after hardening, less grinding allowance need be made, and it is the grinding of the thread that causes the present higher price. Other operations, such as turning, threading, etc., can be more cheaply performed on ground-after-hardening taps than on taps not ground. The problem is to reduce the cost of the operations preceding hardening to such an extent that the saving will balance the cost of the grinding of the threads.

Meanwhile, however, the author believes that in purchasing taps—the same as in buying machinery and tools of all kinds—the deciding factor should not be the price of the tool itself, but the unit cost of the work that it performs. A good product is well worth its higher price.

CALCULATING ANGLE FOR DOVETAIL FORMING TOOL

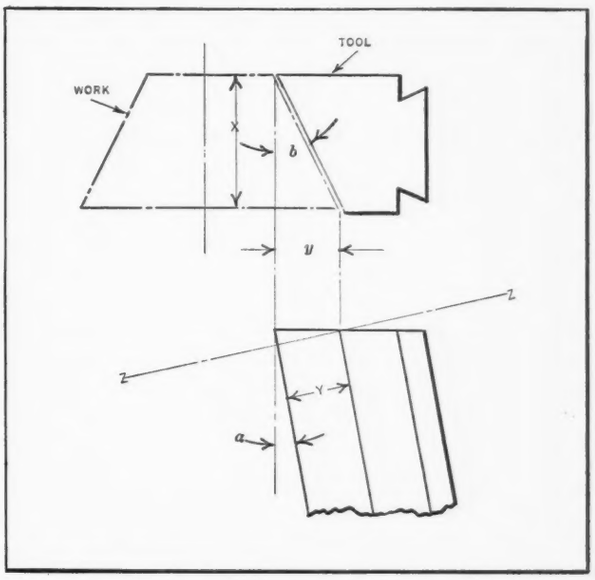
By E. F. MURRAY

For forming work having an angular or conical surface, with a dovetail tool provided with cutting clearance, the angle of the tool will, of course, be slightly different from the angle on the work. The formula given in this article will enable the designer or toolmaker to find quickly the angle required on the tool.

Referring to the illustration, a is the cutting clearance angle on the tool and b the angle on the work; let B represent the angle to be machined on the tool as measured in plane Z–Z, which is at right angles to the cutting elements of the tool. The three dimensions generally needed to figure the angle B are X, y, and Y. However, these dimensions are unnecessary when the following formula is used, in which only the angles a and b are needed. The formula is,

$$\tan B = \cos a \times \tan b$$

The derivation of the formula is as follows:



Calculating Angle of Dovetail Forming Tool

Referring to the illustration,

$$\tan B = \frac{Y}{X} \text{ and } Y = y \times \cos a \qquad (1)$$

Also,

$$y = X \times \tan b \text{ and } X = \frac{y}{\tan b} \qquad (2)$$

Now substituting the values of Y and X in Equation (1), we have:

$$\tan B = \frac{y \times \cos a}{\frac{y}{\tan b}}$$

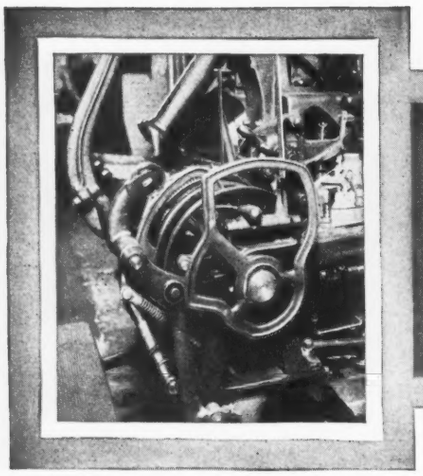
Clearing this equation of fractions,

$$\tan B = \cos a \times \tan b$$

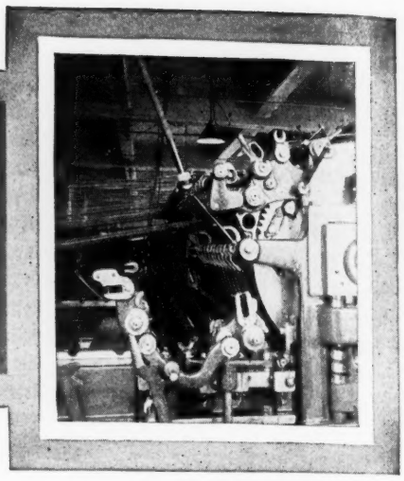
By using this formula, the necessity for solving the equations given in the derivation is avoided.

* * *

An engineering educator says that our engineering schools "keep the students so busy passing examinations that they have no time for study."



Ingenious Mechanical Movements



FORMED CUTTER RELIEVING MECHANISM

By H. C. TOWN

The usual arrangement for relieving cutters so that the original shape can be maintained as the tooth faces are ground in sharpening is to revolve the cutter slowly between centers while a forming tool moves toward the cutter axis and then quickly withdraws while passing the cutter groove. This reciprocating motion is repeated as many times per cutter revolution as there are teeth.

The relieving mechanism to be described operates by moving the cutter toward and away from the relieving tool, the latter remaining stationary except for a slight feeding movement after each cutter revolution. This attachment may be used to relieve either straight or helical milling and gear cutters on an ordinary lathe or on any machine tool capable of driving the attachment and holding a forming tool. The mechanism is designed to give a variable relief from 0 to 5/8 inch; to index all tooth numbers from 48 downward, provided the numbers divide into 48 evenly; to withdraw the cutter quickly from the tool after relieving each tooth; and to traverse the cutter longitudinally for relieving helical and face cutters.

Fig. 1 shows a plan view of the attachment partly in section. It is clamped to the lathe bed, driving slide *A* being fastened to the lathe faceplate. The driving block *B* transmits motion to arm *C*, which swings or oscillates around axis *y–y*. This motion is transmitted through spur gears *D*, *E*, and *F* (see also end view Fig. 2) to pawl *G* and thence through ratchet wheel *H* to work-spindle *J* and the cutter attached to it.

Each revolution of driving plate *A* swings arm *C* through an arc, the extent of which depends upon the radial position of driving block *B*, and pawl *G* moves forward far enough for relieving one tooth and then backward preparatory to the next indexing movement. This intermittent forward and backward motion is also transmitted through gear *F* to eccentric sleeve *K*. Sleeve *K* (see cross-section at right in Fig. 1) contains another eccentric sleeve *L* within which the work-spindle is located. The relative positions of these two eccentric sleeves, which may be varied, determines the amount of relief given to the cutter.

As shown by the cross-section, Fig. 1, sleeve *K* is bored 5/16 inch eccentric, and sleeve *L* is also bored 5/16 inch eccentric; hence, by turning sleeve *L* relative to *K* the total eccentricity may be de-

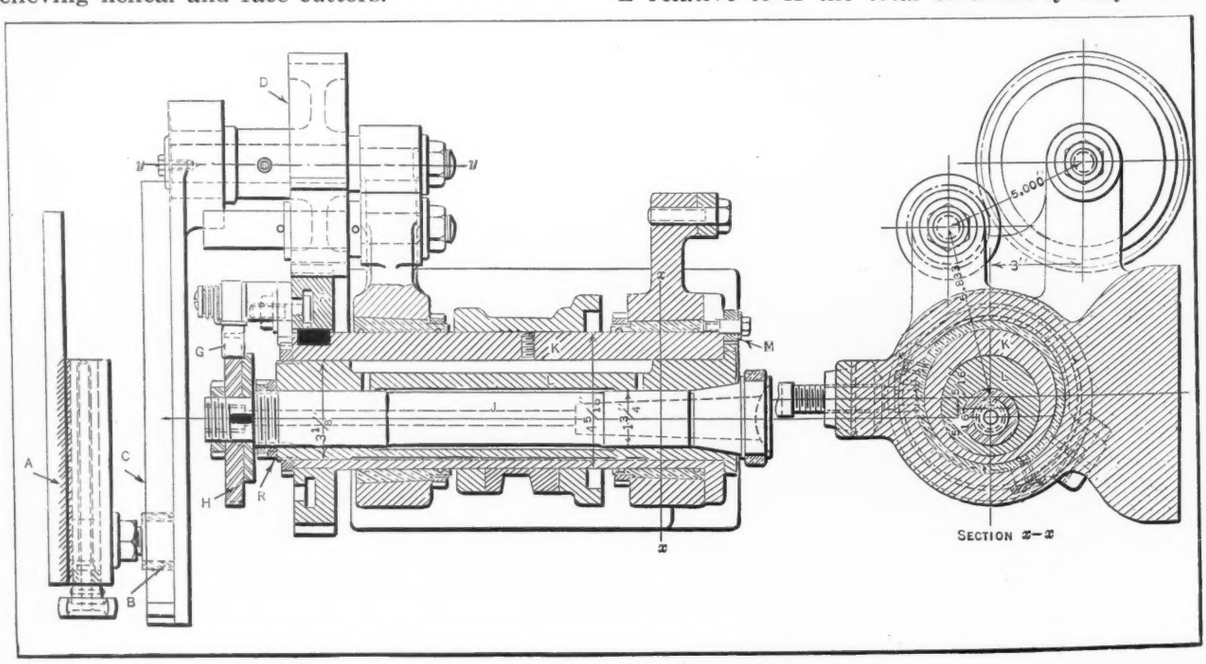


Fig. 1. Plan View of Attachment for Relieving Formed Cutters

creased from a maximum of 5/8 inch down to zero, one eccentric neutralizing the other at the zero position. The amount of relief is varied in this way, as will be described more fully in connection with an actual example.

After sleeves *K* and *L* have been set to give the required relief, sleeve *L* and spindle *J* are maintained in the same relative positions during the entire relieving operation by pawl *M* (see also end view Fig. 3), which moves sleeve *L* forward each time *K* moves forward.

When a cutter is being relieved, the axis of spindle *J* swings toward the stationary tool an amount equal to the relief required, and as this inward motion occurs, pawl *G* turns the cutter far enough to traverse the tool across the surface being relieved. Then sleeve *K* returns, which withdraws the cutter to the starting point, placing it in position for relieving the next tooth, but pawls *G* and *M* merely ride over their respective ratchets so that the cutter and sleeve *L* are not turned backward.

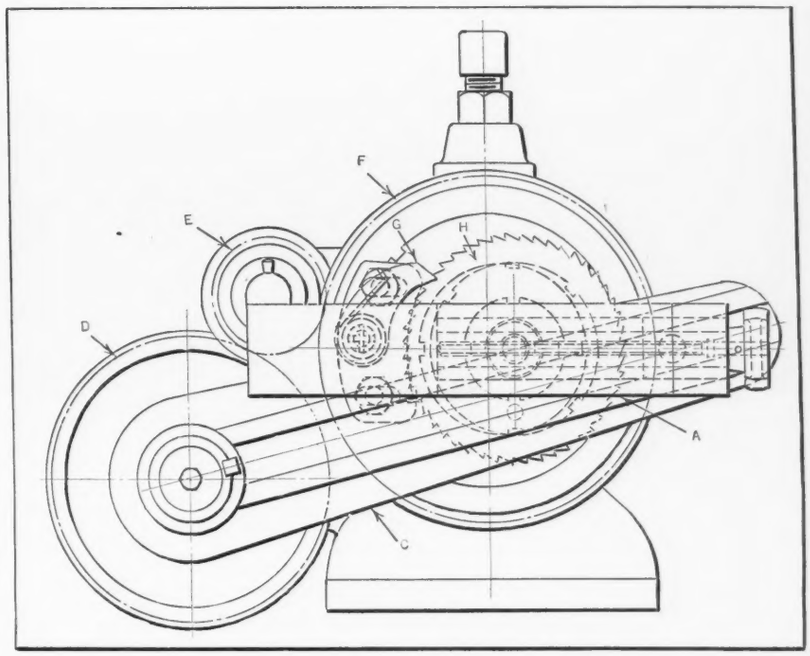


Fig. 2. End View of Relieving Attachment

The cutter is given a quick return movement after the relieving cut, because when driving block *B* is swinging arm *C* upward for the return stroke, it is acting much nearer the fulcrum *y–y* than when arm *C* is swinging downward for the relieving or cutting stroke.

Method of Relieving a Cutter

The method of relieving a cutter having 12 teeth will be described to illustrate the actual application of this attachment. The cutter is mounted on an arbor inserted in spindle *J*, Fig. 1, and the forming tool is clamped in the toolpost. As ratchet wheel *H* has 48 teeth and there are 12 teeth in the cutter, it is necessary for pawl *G* to move 4 teeth for each indexing movement ($48 \div 12 = 4$). The screw in slide *A* is used to adjust the radial position of block *B* until pawl *G* moves the required amount. The block that carries pawl *G* can be clamped in any circumferential position, as the clamping bolt engages a circular T-slot extending around the side of gear *F*. This adjustment permits varying somewhat the effective travel of the pawl and also placing it in the best position relative to the ratchet wheel, the location of which depends upon the eccentric setting of sleeves *K* and *L*.

The next adjustment is to obtain the required amount of relief. If we assume that 5/16 inch relief if desired, this may be obtained merely by adjusting sleeve *L* until a mark on its flange is opposite the graduation 5/16 inch on the flange of sleeve *K*. Some of these graduations may be seen in Fig. 3. The final adjustment is by means of lever *N*, which is loosened and turned about quadrant *Q* far enough to locate the cutter teeth in the proper relation to the relieving tool. Lever *N* serves a double purpose, however, the primary use being to provide sufficient friction to prevent the cutter from moving backward when the movement of pawl *G* reverses. Lever *N* engages a grooved

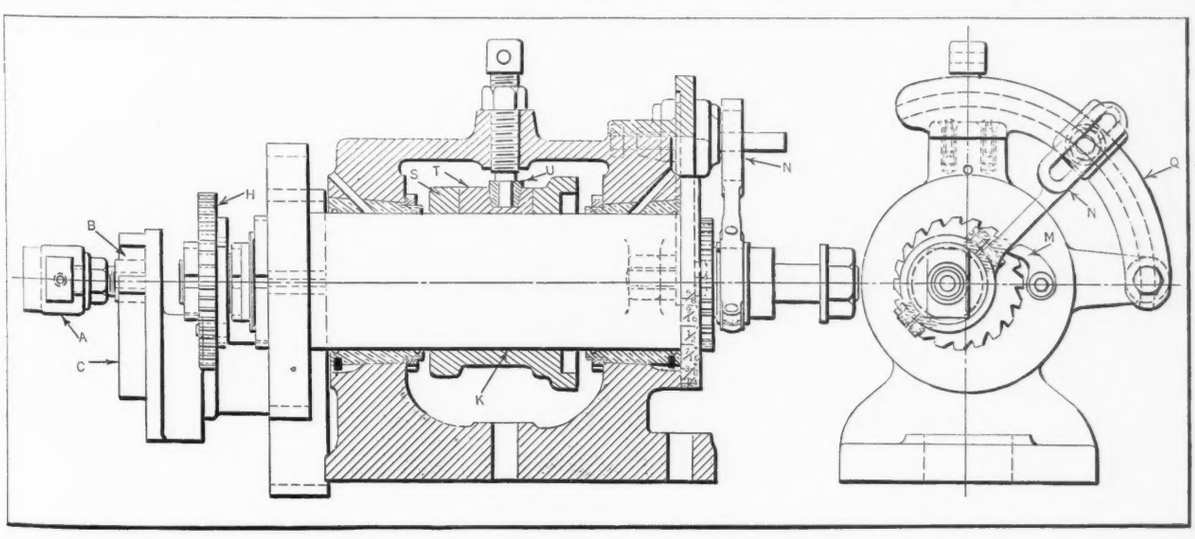


Fig. 3. Attachment Arranged for Relieving Helical or Face Cutters

flange on the chuck spindle, and it has an adjustable cap to obtain the necessary friction. Sleeve *L* is also safeguarded against a reverse movement by locknut and friction ring *R* (Fig. 1) on the spindle, there being sufficient friction between the spindle and sleeve to prevent backward motion when pawl *M* reverses.

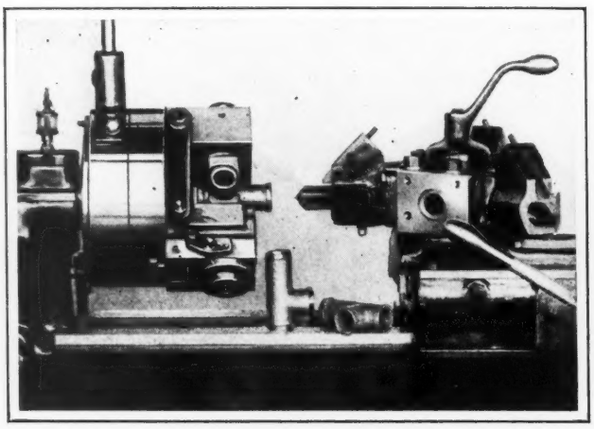


Fig. 1. Turret Lathe Operation Requiring Chuck Having Indexing Jaws

When driving plate *A* is revolved, the block *B*, while passing through the front arc of its travel, imparts a relatively slow and powerful turning movement to arm *C*, and this motion, transmitted through the gearing and pawl mechanism described causes the cutter to revolve and at the same time approach the forming tool in an eccentric path; thus, one tooth is partly relieved. Block *B* is now revolving upward through the backward part of its arc, which swings arm *C* upward at a comparatively rapid rate, thus withdrawing pawls *G* and *M* and reversing the rotation of sleeve *K*, which returns to its starting point. This motion, as previously explained, does not alter the relative positions of spindle *J* and sleeve *L*. The next tooth is now in position for the relieving cut, and after one revolution of the cutter, the forming tool is, of course, fed inward slightly for the next series of cuts around the cutter.

For relieving helical cutters or face cutters, a longitudinal movement of the cutter is required. To obtain this when necessary, sleeve *K* is made a sliding fit in its bearings and long enough for any endwise movement likely to be needed. A cam-holding sleeve *S*, Fig. 3, is mounted on sleeve *K*, this sleeve being split to allow clamping. It is also slotted to receive a cam segment *T*, which is held in position by small steel plates. A cam groove of the required curvature is engaged by roller *U*, so that any rotation of sleeve *K* and the cam attached to it causes a longitudinal movement. For straight relieving, a segment *T* having a straight or circumferential groove is used, so that roller *U* prevents any longitudinal movement. The gears of this attachment have teeth of 6 diametral pitch, gear *D* having 40 teeth, gear *E*, 20 teeth, and gear *F*, 50 teeth.

* * *

CHUCK THAT MAY BE INDEXED WHILE REVOLVING

By I. F. YEOMAN

The chuck shown on a turret lathe in Fig. 1 is equipped with two special indexing jaws for gripping a three-way brass fitting and indexing it for machining each of the three open ends without stopping the machine. The indexing is controlled by a lever on the side of the machine, which operates the automatic chuck and bar feed mechanism.

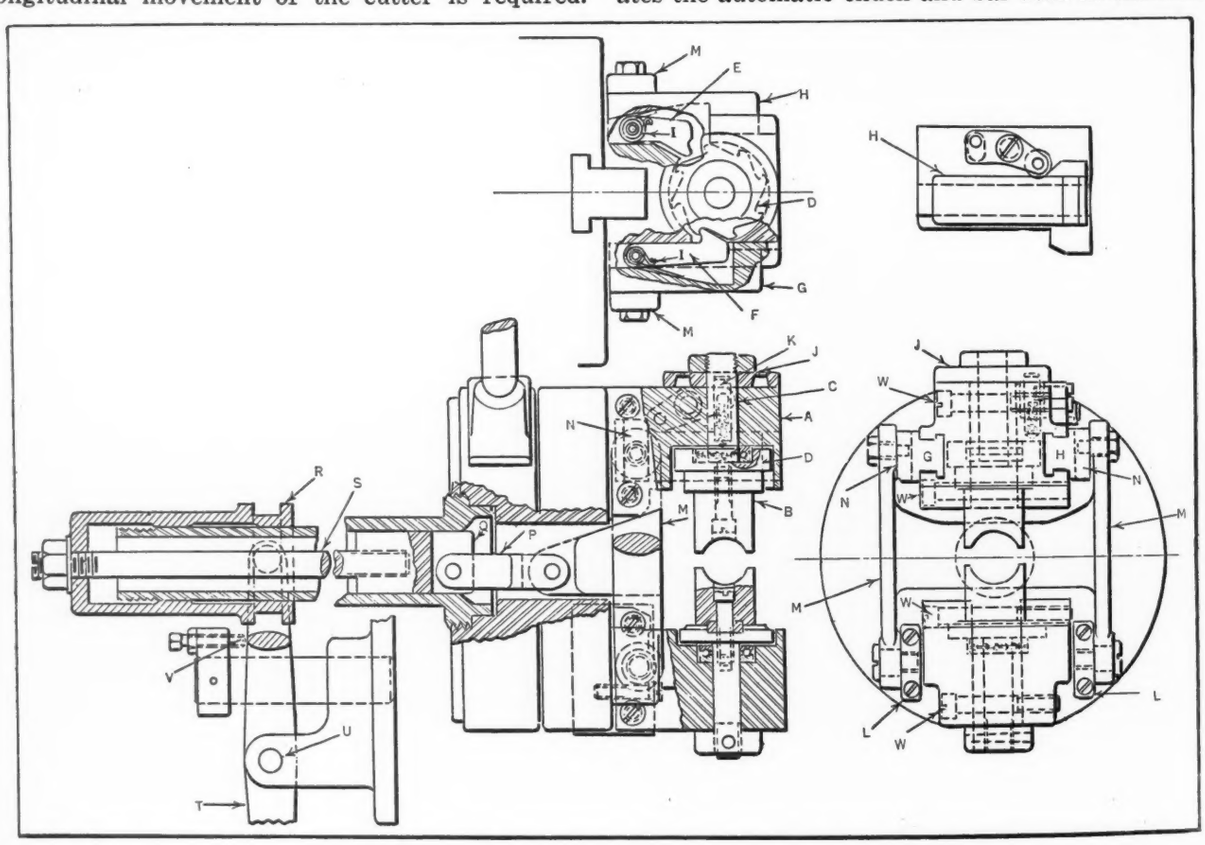


Fig. 2. Design of Chuck Shown on Turret Lathe in Fig. 1

The jaw block *A*, Fig. 2, contains the indexing mechanism. The indexing jaw *B* is integral with the stem *C*. At *D* there is an eight-tooth ratchet (see also the plan view). Pawls *E* and *F* engage this ratchet, and rotate the jaw. The slides *G* and *H* carry the pawls, and are tongued and grooved into the jaw block *A*.

The forward movement of slide *H* engages the push-pawl *E* and rotates the ratchet one-eighth of a revolution, and the return movement engages the hook-pawl *F*, which completes the one-quarter turn required for each of the three positions. The springs *I* hold the pawls in the proper position for engaging the ratchet.

The plate *J* is keyed to the stem *C*. The under side of plate *J* is drilled and reamed taper at three places to receive the lock-bolt *K* for retaining each indexed position. The lock-bolt is operated by a cam made integral with the slide *H*, as shown by the detail view of the slide (upper right-hand corner of Fig. 2). Referring to the plan view of the jaw, it will be noted that there is considerable clearance between pawl *E* and ratchet *D*. This is so that the cam on the jaw *H* will pass under the roll of the side lever and rock it far enough to extract the lock-bolt from the index-plate before the pawl *E* starts rotating the ratchet.

Looking at the end view of the chuck, two lugs are attached to the chuck face at *L*. The lower ends of the yoke *M* are pivoted to lugs *L*. The upper ends of the yoke *M* are pivoted into grooves cut transversely across the slides *H* and *G* at *N*. A projection of the yoke connects through a link *P* with a plunger *Q* which slides in the spindle.

The sleeve *R* slides over the rear end of the spindle and replaces the wedge used in the regular automatic chuck mechanism. Sleeve *R* also connects with the plunger *Q* through the rod *S*. The special yoke *T* has rolls that engage the groove in the sleeve *R*. This yoke pivots at *U* in a bracket on the machine, and its lower end is attached through a link to a rocker arm, swung by a hand-lever which operates an ordinary bar feed mechanism. Stop *V* limits the rearward movement of the sliding mechanism.

The indexing jaws are both supported on ball thrust bearings. The lower jaw is only a carrier. The jaw blocks are grooved to slip over the master chuck jaw and are bolted entirely through the master jaw, as shown at *W* in the end view.

These jaw blocks are attached to a two-jaw chuck, but they can be designed for fixtures or faceplates. The material used throughout in the jaws is steel; the yoke and sleeve are of cast iron. Jaws designed as described should not be considered for other than light and medium light work, as the gripping required for heavy work causes a thrust so great that the jaws cannot be revolved by the hand-lever, and to release the jaws slightly for indexing will cause misalignment of the machined surfaces.

In machining the brass parts for which this indexing chuck is used, each of the three diameters is bored to a different depth; hence, three boring heads must be used on the turret. The threads on each of the three diameters, however, are identical and, therefore, could be cut by using only one die-head, which is the method formerly employed. This method required a lot of extra turret indexing in order to swing the die-head back to the work. The present method is to use three die-heads, there being one after each boring position. This arrangement, in conjunction with the indexing mechanism, saves much time, as 665 pieces can be machined daily. Fig. 1 shows the turret without the die-heads in position.

* * *

STAND FOR HOLDING PISTON VALVES

By J. R. PHELPS, San Bernardino Shops, Atchison, Topeka & Santa Fe Railway Co., San Bernardino, Cal.

The special stand shown at the left in the accompanying illustration is used for holding piston valves, as shown by the right-hand view, while assembling them. A 3-inch pipe is set into the floor deep enough to provide space for the valve stems. This arrangement makes it unnecessary to place blocks under the valve so that the stem will clear the floor. The four legs of this stand are made of 3- by 3-inch angle-iron, and the top is a circular casting, 18 inches in diameter.

Empty Work Stand at Left, and Stand with Piston Valve in Place at Right

* * *

CORRECT GRINDING LENGTHENS TOOL LIFE

By U. SETH EBERHARDT, Newark Gear Cutting Machine Co., Newark, N. J.

Referring to the article on page 857 of July MACHINERY, the writer was of the same opinion as Mr. Dowd until it was found, after a great many tests had been made on all kinds of turning and boring operations, especially on roughing cuts, that a clearance angle of about 30 degrees is nearly right. On long cuts, a tool with a larger clearance angle will turn to a more uniform size, apparently because the flat on a slightly worn tool is not so big as it would be if a smaller angle were used. When the tool is ground to a smaller angle, say 5 degrees, a slight amount of wear gives the tool quite a large flat at the cutting point.

Since our company settled on a larger angle, I was agreeably surprised to find, in the Handbook of the "Lo-Swing" lathe, that all the roughing tools shown are ground with a back angle of 30 degrees.

Selecting Electric Heat-treating Equipment

First of Two Articles Explaining the Various Points to be Considered in Planning Installations

By EDWIN FLEISCHMANN, Westinghouse Electric & Mfg. Co., Chicago, Ill.

MANY plant engineers, when confronted with the problem of selecting electric heat-treating equipment, are at a loss to know which type of apparatus will perform the work most efficiently, give the longest life, and cost the least for upkeep. It is almost superfluous to say that the plant engineer should know exactly what he is buying, and it is just as essential that the furnace manufacturer have a clear conception of what is required; much harm may be done by the purchase of unsuitable apparatus. The points to be outlined in this and a second article may well be given consideration in determining what kind of equipment to purchase for the particular work to be handled. All the suggestions are accepted as good practice by reputable manufacturers. The examples suggested represent by no means the only ways of accomplishing the desired ends, and in each case, the illustrations merely show one good way of meeting requirements.

Both articles will deal specifically with electric furnaces of the resistor type, such as are commonly employed for heat-treating work at temperatures up to 1850 degrees F. However, the statements made, with the exception of those under the heading "Facts Concerning the Heating Elements" of the second article, also apply to furnaces for higher temperatures, which are chiefly confined to laboratory use.

Metallic resistor type furnaces are essentially simple in construction and operation. The refinements, which are often attached to them, are

EDWIN FLEISCHMANN, industrial heating engineer of the Westinghouse Electric & Mfg. Co., with headquarters at Chicago, Ill., was born in Orchard Park, N. Y., in 1899. After graduating from the high school of Hamburg, N. Y., he entered the engineering school of Harvard University, from which he graduated in 1920 with an A. B. degree, and later received the degree of S. B. in electrical engineering in 1922. Immediately upon leaving Harvard in 1922, he entered the graduate student course at the Westinghouse Electric & Mfg. Co., and for two years was engaged in work on furnace design and on the heating of steel in furnaces in the electric heating department. In 1924 he took up his duties at the Chicago office. Mr. Fleischmann has assisted in the development of industrial furnaces and has written an instruction book on oven heaters. He is also the author of an article pertaining to industrial heating that appeared last year in the National Electric Light Association's bulletin. Mr. Fleischmann is a member of the American Institute of Electrical Engineers, the American Society for Steel Treating, and the Harvard Engineering Society of New York.

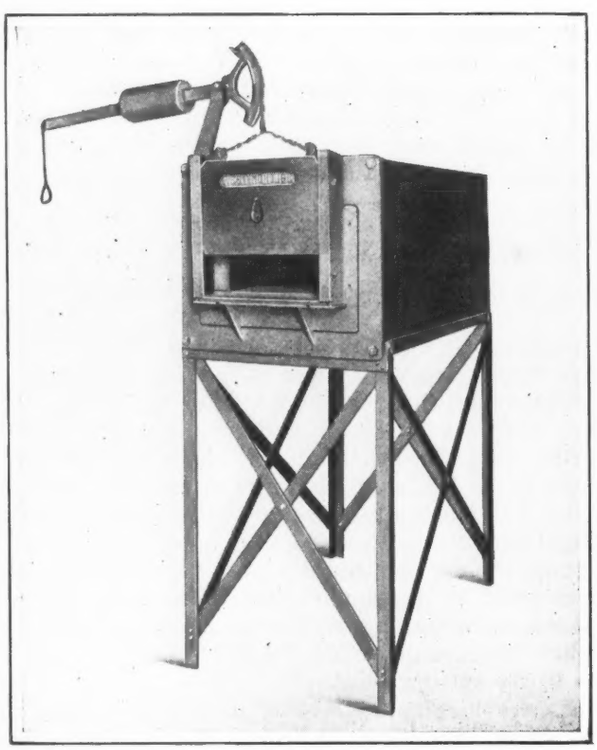


Fig. 1. Typical Furnace Designed for Light Toolroom Service

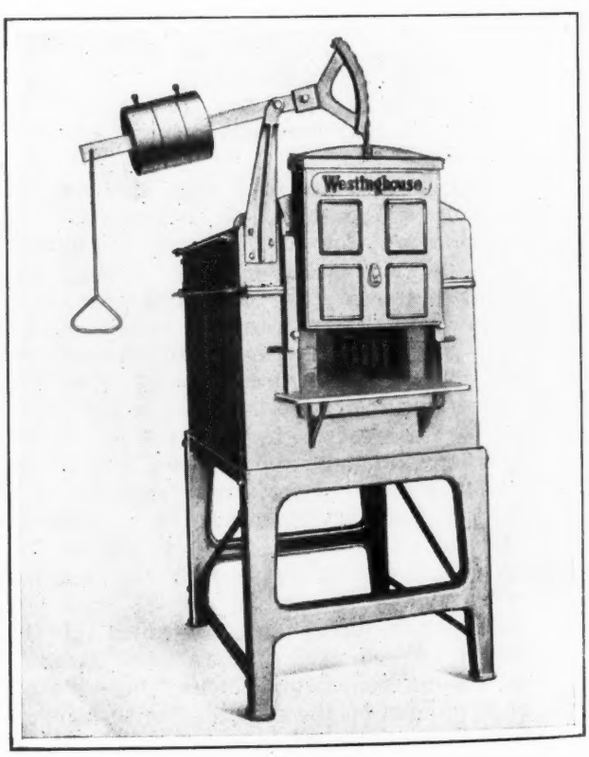


Fig. 2. Small Heat-treating Furnace for Heavy Shop Duty

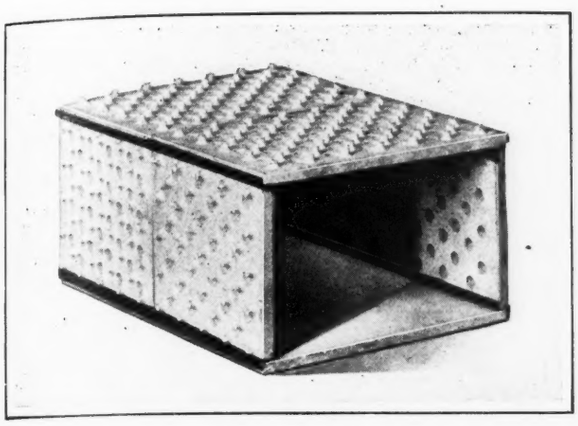


Fig. 3. Perforated Muffle Used in Light-duty Furnaces

merely mechanical modifications to facilitate the handling of materials, increase the accessibility of heating elements, or insure more accurate temperature regulation. Fundamentally, an electric furnace consists of a supporting structure or shell; a layer of insulation to conserve the heat, usually with a refractory lining on the inside; some provision for getting work into and out of the enclosure; a means of producing heat within the chamber; and a suitable control for the temperature. Each of these points will be considered in succession.

The Shell and Supporting Frame

In judging the shell and supporting structure, some consideration must be given to the purpose for which the furnace is to be employed. The differences in design, for instance, between the furnaces illustrated in Figs. 1 and 2 indicate that they are intended for essentially different jobs. Fig. 1 shows a furnace primarily intended for laboratory or light tool-room service, while Fig. 2 illustrates a heavier unit designed for production work and regular shop heat-treating.

When the equipment is to be subjected to rigorous service, a very heavy framework is important, as in the case of the furnace shown in Fig. 4, which is used for annealing locomotive side-rods. Heavy buckstays and tie-rods support the brickwork, and the whole structure is proportioned to the load it must carry. With large furnaces, a heavy construction is required, to prevent failure not only from rough usage, but also from the stresses of heating and cooling.

Smaller furnaces of the hearth type, such as shown in Fig. 2, should have strong legs made of structural steel and cast iron, a protecting shell of boiler plate, and cast-iron front and rear pieces. The latter are particularly advantageous; the front casting is usually very hot around the door and along the top, and comparatively cool at the sides and bottom. Sheet-metal parts warp badly under such service and, when out of shape, cause the door to stick or jam. When closed, the door often rests upon the shelf, and hence this part of the front casting will ordinarily be on the same level as the hearth.

Economy dictates that the door mechanism be simple and positive in operation. A cast-iron front frame assures a smooth surface, against which the door can slide. Lugs and guides should be provided so that the door is held tightly against the frame when closed, but moves easily while being opened. A small sand seal is sometimes provided across the top of the door to decrease the inevitable heat losses at this point.

Desirable Door Construction

The door should be a casting—a sturdy box filled with insulating material. Some provision is necessary to prevent the insulation from crumbling under the heat and falling into the chamber. When this happens, the door may become locked in the closed position, so that considerable work is necessary to free it. The trouble can be effectively prevented in small units by building refractory plates into the chamber side of the door, or by using refractory lining-bricks in larger units. An observation hole in the door is convenient, but it should be covered.

A simple counterweighted arm or lifting mechanism is important to aid in operating the door. When a counterweight-and-chain lifting device is used, it should be possible easily to raise the door against the friction of the chain wheels. In very large furnaces, some sort of automatic pneumatic or electric device is resorted to for raising the door. In either case, care must be exercised to interlock the door-lifting mechanism so as to prevent raising the door while the current is on. Limit switches are necessary in the case of an electric door-raiser, to prevent over-travel. The operating simplicity of the electric door-lifting arrangement has much to recommend it. Also, it may be readily inter-connected, when desirable, with other features of the heating cycle. The pneumatic system requires an air line or separate pumps.

Various Kinds of Insulation

The thermal insulation inside the shell is ordinarily built up of bricks or molded slabs, which can be made self-supporting by proper design, allowing for expansion. A powdered form of in-

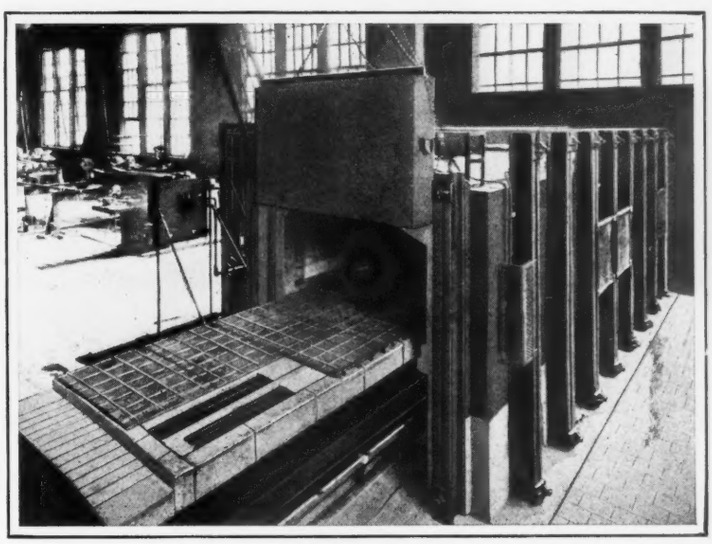


Fig. 4. Large Car-bottom Furnace Used for Annealing Locomotive Side-rods

sulation is also employed, but bricks are often preferable, since they make a neater and more permanent construction. The ultimate insulating properties of brick, powder, and molded slab insulation seem to be nearly the same. Molded insulation has the virtue of being easy to assemble and of requiring no external support, as powder does. The insulation most often used in furnaces is probably "Sil-o-cel." This material has a high insulating value and comparatively low specific heat, which means that its absorption is not great. Other good materials might be listed as well. (Comparative properties of insulating materials, with thermal conductivities and specific heats, were listed in "Heat Insulating Materials for Electrically Heated Apparatus," by J. C. Woodson, Transactions of the Electrochemical Society, Vol. XLIII, May, 1923).

The vital point about the insulation is the thickness, which should be adequate on all sides. When arched roofs are used, the insulation is sometimes allowed to be thinner at the apex of the arch than elsewhere. As the apex is probably the hottest part of the furnace, such practice increases radiation losses considerably. The criterion of insulating effectiveness is always the so-called radiation losses, which are, in reality, due to conduction through the insulation, and radiation from the surface of the shell. The latter can be reduced one or two per cent by painting the shell with aluminum or some other light-colored paint. It is at maximum when the shell is black. Ordinary paint cannot be used, because the temperature of the shell often runs to 150 or 200 degrees F. and higher.

Losses due to conduction through the insulation can be decreased by means of thicker material, careful design, and meticulous workmanship in laying up the brickwork. Absolute figures cannot be given for proper balance in regard to thickness. The losses should be weighed in each case against the cost of adding more insulation. In small furnaces, thicknesses of 5, 7, and 9 inches are often met with, and in larger units, thicknesses of from 9 to 13 inches are generally used.

Purpose of the Refractory Lining

When furnaces are used less than twenty-four hours a day, the absorption of the brickwork and insulation is likely to be considerable and can only be decreased by suitable design. It is customary to place inside the insulation a lining of firebrick or other refractory material made for the purpose. This layer protects the insulation from disintegrating under the effects of the comparatively high heating-element temperatures, and is essential in nearly all cases.

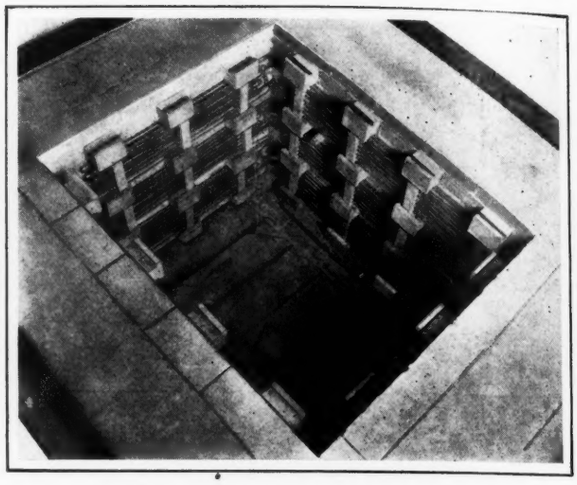


Fig. 6. Rod-type Heating Elements Arranged on Walls of a Pit Furnace Used for Annealing

However, if the lining is made too thick, the rapidity of initial heating up may be decreased materially, because all refractories have comparatively high specific heats, which means excessive absorption. In most furnaces, the temperature can be reduced sufficiently to protect the insulation by using one course of refractory brick, 2 1/2 or 4 1/2 inches thick, and, in large units, 9 inches thick. In very small laboratory units, a thin plate, perhaps 3/4 inch thick, serves the same purpose and also supports the heating elements. While the losses should be low, they bear a definite relationship to the absorption and, consequently, to the heating-up time of furnaces. A balanced design will strive toward the most favorable conditions in both directions.

How the Hearth Should be Constructed

In small laboratory furnaces, a refractory hearth may be sufficient for light service, but in all other box-type furnaces, some sort of cast-metal floor plate is almost indispensable. Because of the high temperatures, the floor plate should preferably be made of an alloy similar to that used for heating elements, but, in any event, the iron content should be as low as possible for long life. Sheet-metal floor plates often warp badly under temperature changes, and hence they are not suitable for many applications. Cast floor plates should be carefully designed to prevent distortion. They should be provided with a lip around three sides to keep scale and dirt from working over the edges and fouling the bottom heating elements. Floor plates should be grounded to the frame, but should be easily removable to permit examination of the heating units beneath.

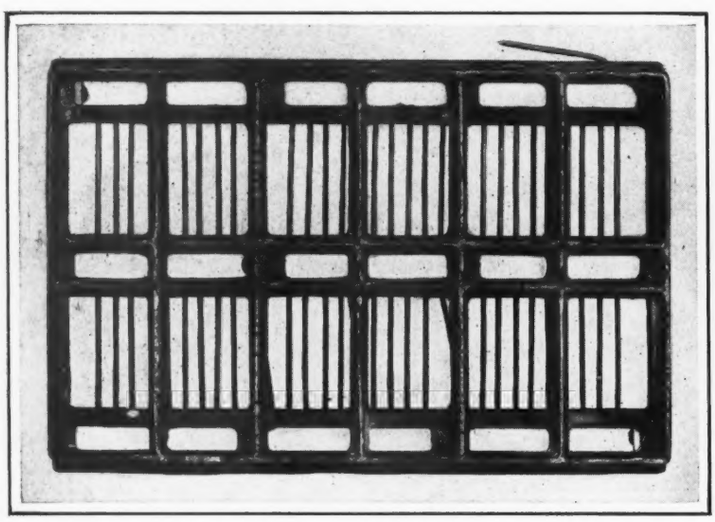


Fig. 5. Cast Nickel-chromium Grid Work for Protecting and Supporting a Heating Element of Heavy Construction

In the larger box-type, car-bottom, and rotary-hearth furnaces, the floor plates are frequently made in sections, in order to provide for expansion over the larger surfaces. When this is done, care must again be taken lest an accumulation of foreign matter damage heaters beneath the plates. Prompt burnouts will result from such a condition.

All parts of conveyors, pushers, walking beams, and the like, which enter the heated zone, must be made of some heat-resisting alloy. The use of iron or steel for these parts means frequent replacement, because of the rapid oxidation of those metals at high temperatures. Attention should also be devoted to the provisions for loading and unloading automatic furnaces. In general, most chain-type conveyors are extremely inefficient when applied to electric furnaces, except where it is possible to have the returning chain wholly inside the furnace chamber. The mechanical details of the conveyor can best be determined by the plant engineer in each individual case, as they depend largely upon the character of the material to be handled and upon the cycle of operation.

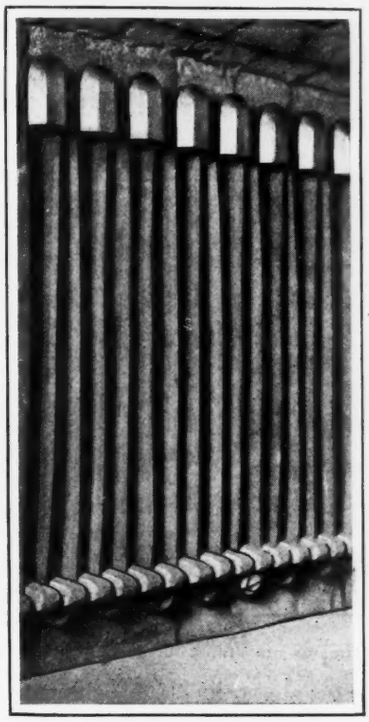


Fig. 7. Ribbon Type of Heating Element

Supporting the Heating Elements

Various methods are in use for supporting the heating elements inside the furnace chamber. Probably one of the first, historically, was the solid refractory muffle. While this was effective for laboratory applications, it involved a temperature gradient between the heating element and charge that was much too high for many industrial applications. The next step in this development was the perforated muffle, similar to that shown in Fig. 3, wherein, for laboratory and light industrial work, a compromise was struck between the high temperature differences of the solid muffle plate and the totally unprotected heating elements.

Present-day heavy industrial service dictates the mounting of the heating elements in refractory pieces held by a cast, heat-resisting alloy grid. This makes the heating unit self-supporting and open, and yet it is protected against mechanical injury while the furnace is in operation. Such a construction, which is used in the furnace illustrated in Fig. 2, is shown in Fig. 5. These remarks, of course, apply only to furnaces of moderate size. In larger furnaces, it is possible to support the elements directly on the furnace wall by means of T-bricks or hooks built into the wall and cleats fitting into them. The furnace shown in Fig. 6, which is used for annealing Norway-iron solenoid plungers in boxes, employs elements mounted in this way. Fig. 7 shows a flat-ribbon type of construction used in large furnaces.

In any event, the supports should cover as little as possible of the heating element surfaces, in order that the heat generated in them may be readily gotten rid of. Whether rod or ribbon elements are used, ample provision must be made for expansion around or through the supports. The material of which the supports are made must retain its high electrical insulating quality at furnace temperatures. If this is not the case, grounding will result, together with a complete breakdown of the heaters. The material must also have a low specific heat, in order that little heat may be absorbed by it. And, if the supports are in the form of muffle plates, they must have a high coefficient of thermal conductivity, so as to assist radiation from the heating elements.

* * *

PRINTING MACHINERY TO BE DISCUSSED

A meeting will be held under the auspices of the Printing Machinery Division of the American Society of Mechanical Engineers at noon, September 14, at Hotel Commodore, New York City, during the Graphic Arts Exposition. All interested in printing and in the graphic arts in general are invited to attend the meeting, which will be held in conjunction with a luncheon. William C. Glass, chairman of the Printing Machinery Division, may be addressed in care of the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

* * *

CONSERVATION OF FUEL

A meeting of the Fuel Division of the American Society of Mechanical Engineers will be held in St. Louis, Mo., October 10-13. Millions of tons of fuel are being consumed annually in a wasteful manner. Considering the cost of the fuel, the damage to property, and the menace to health caused by imperfect combustion, the Fuel Division of the American Society of Mechanical Engineers believes that some action should be taken to improve the present methods of burning coal and other fuels. Some of the twenty-six papers to be presented are: "American fuel resources," "Factors governing the purchase of fuels," "Industrial applications of heat," "Application of powdered fuel," "The burning of liquid fuels," "Automatic combustion control," "Managing a smoke abatement campaign," "Smokeless and efficient firing of domestic furnaces."

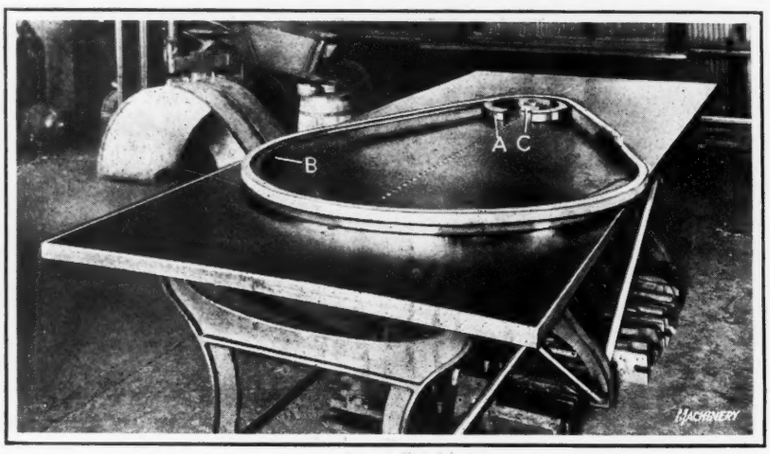
* * *

According to a survey made by the Automotive Division of the Bureau of Foreign and Domestic Commerce, there is one automobile for every five people in the United States, one to every eleven in Canada, one to every twelve in New Zealand, and one to every seventeen in Australia. In the United Kingdom there is one to every 43, and in France one to every 46. Denmark, Argentina, Sweden and Switzerland also rank high in the number of cars in proportion to the population, while the Netherlands, Germany, Spain and Italy rank lower.

THE GERMAN MACHINERY INDUSTRY

According to a report by Trade Commissioner Theodore Pilger of Berlin, Germany, to the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., 1926 was a banner year for exports of German metal-working machinery, the exports amounting to 60,600 metric tons. Only twice in the history of German industry has this tonnage been exceeded—in 1913 and in 1920, in which latter year the currency inflation promoted exports. The value of the exports of metal-working machinery in 1926 amounted to 94,000,000 gold marks, or 15 per cent more in value than in 1913. These export statistics do not include "reparation deliveries in kind," which would, if included, swell the export volume. Machine tools constitute approximately 90 per cent of the metal-working machinery exported.

German manufacturers in 1926 were also able to hold their own markets to a greater extent than formerly. The imports from abroad amounted to only 2683 metric tons, or 42 per cent of the tonnage imported in 1913. Before the war, Germany's imports of this class of machinery were about 12 per cent of the export tonnage. In 1926, the import tonnage was only 4.4 per cent of the exports. The trade with Russia in metal-working machinery increased tenfold over the trade in 1925. The exports in 1926 to all countries were 35 per cent greater than in 1925.



Lay-out Table with Forms on which Safety-guard Angle-irons are Checked

Imports of Metal-working Machinery

Of the imports of metal-working machinery into Germany, 61 per cent came from the United States. The volume, however, was only about 40 per cent of the imports of metal-working machinery from the United States in 1913. Of the exports in metal-working machinery from Germany, the United States imported 11.1 per cent in 1926, a rather appreciable percentage.

It is stated that, aided by such governmental aids as the Russian credit guarantee and by the complete elimination of labor troubles, the German metal-working machinery industry is today in a position to obtain a considerable foreign trade. German wages and the standard of living for workmen are practically at the lowest possible point which will permit existence. "The openly acknowledged copying of American machine tools by German factories," says Mr. Pilger, "in connection with the low wage level and inferior standard of living of workers and employes in the machine-tool building trades of Germany, makes these factories formidable competitors who will undoubtedly make a determined fight for the American market."

Referring to the Leipzig Fair, Mr. Pilger has the following to say: "Technical progress in German machine tool manufacturing was certainly noticeable at the Leipzig Fair. None of the post-war fairs have ever displayed such a multitude of well-built high quality machine tools as the Spring Fair of 1927. To mention only a few features: Complicated speed change gears are being eliminated; ground gears predominate; the multiple tool lathe is beginning to compete successfully with turret and automatic lathes, and turret lathe producers are turning to turret heads with eight tools in order to fight this competition; boring machines, in both one and multiple spindle types, are being improved; American-type centerless grinders are being produced by several firms. The only machine tool which remains undeveloped by the German manufacturer is the milling machine."

* * *

LAY-OUT TABLE USED IN MAKING GUARDS

In making sheet-metal gear guards in the plant of the General Electric Co., Schenectady, N. Y., the operation is considerably facilitated by using the lay-out table here illustrated. This table is used in forming the angle-irons to which the sheet-metal pieces are fastened. Each angle-iron is heated in a furnace close to the table; then one end is clamped to the form and finally the angle-iron is hammered into shape around the radius blocks *A* and *B*. Blocks of various radii are kept on hand, and are selected to suit the radii required at the two ends of the guard. The forms are located the desired distance apart on the table, and held in place by means of backing blocks, such as shown at *C*. Each block is secured to the table by a bolt which is inserted in one of the holes in the middle of the table.

* * *

It has been pointed out that the cost of bus operation per mile is considerably less than that of the operation of a steam railroad train, the cost per mile for a bus being approximately 30 cents, while that for a steam train is estimated at $1.10. This does not mean that buses would always be more economical than steam trains for transportation purposes. If, for example, 300 passengers were to be moved at one time from Philadelphia to Atlantic City, then a steam train would be more economical, as its operating cost would be approximately $1.10 per mile, as compared with $3.00 per mile for ten motor buses, each carrying thirty passengers; but if only thirty passengers were to be moved, then the economical choice would be reversed, as the steam train would cost more than three times as much to operate as one motor bus.

Systematic Lathe Inspection

By WILLIAM B. WESSELS

CAREFUL inspection of the assembled machines is necessary to the successful manufacture of accurate lathes. The ideal lathe inspector is a man who exercises keen judgment, possesses a good memory, and is a first-class lathe operator. He is also familiar with the operation of other types of machine tools and is capable of performing high-grade bench work.

Men of these qualifications are increasingly difficult to find, and so it usually becomes necessary for manufacturers to train men for lathe inspection. These men must be taught the manner in which a lathe should be operated for different kinds of work, how to determine when various adjustments are necessary, the proper method of making these adjustments, and the way in which the degree of alignment and accuracy of important parts should be checked and corrected.

WILLIAM B. WESSELS was born in Covington, Ky., in 1885. Since he was fifteen years of age, he has worked continuously in the machine tool field, supplementing his work by night study. For many years past, he has been engaged in the inspection of precision machinery and equipment. During this period he has given much thought to the proper specification of limits in the manufacture of accurate parts. Mr. Wessels is an active member of the Cincinnati Foremen's Club and of various fraternal and religious organizations.

The capable lathe inspector asks himself many questions concerning each machine before he permits it to pass inspection. To assist inspectors in considering all important factors in the construction of each lathe before the machine is released to the stock-room or shipping department, the writer has drawn up a list of questions. Inspectors using this questionnaire should place check marks beside each item of the list that does not pass inspection. The questions could be supplied to the inspection department in printed sheets arranged as follows:

INSPECTOR'S REPORT TO LATHE FINISHERS

Machine Order No. —— Size —— x —— Bed. Construction No. —— (Check marks have been placed beside all items on this list that are unsatisfactory, and these items must be corrected immediately on the lathe.)

Bed, Pan and Legs

Is bed level? ——— Is spotting done neatly and without scratches? ——— Are tops of vees polished? ——— Does pan leak? ——— Are legs drilled for lag screws? ———

Single Back-geared Head

Is spindle properly adjusted? ——— Does head heat up at high speed? —— Have spindle bearings been examined? —— Are bearings O.K.? —— Does head cone take oil? —— Does head cone run true? —— Do all bearings take oil? —— Has cone the proper end play? —— Is cone polished and free from scratches? ——— Does back-gear run true and noiselessly? ——— Are gear guards properly fitted? ——— Is back-gear set properly? ——— Does it take oil? ——— Is bushing countersunk? ——

Friction Double Back-geared Head

Do gears run true? ——— Do gears run smooth? ——— Do friction clutches release when neutral? —— Is shifter handle set central? —— Is back-gear bushing countersunk? —— Is back-gear set for proper gear play? ——

All-geared Head

Do all gears run smooth? —— Do gears shift easily? —— Does pump work properly? —— Has strainer been cleaned after running machine? —— Do all bearings take oil? —— Is head free from oil leaks? —— Does brake work properly? —— Does drive friction-clutch release properly? —— Is head of plain or reversing type? —— Does drive friction-clutch get oil? —— Is friction-clutch properly adjusted? —— Does faceplate fit spindle nose? —— Does hole in spindle nose run true with faceplate on? ——

Motor-in-Leg

Is motor securely fastened in leg? —— Is motor in proper alignment with drive of head? —— Is motor properly enclosed and free from chips or dirt? —— Is lathe belt- or chain-driven? —— Does motor pulley run true? —— Does motor vibrate lathe? —— Is chain or belt guard properly fitted? —— Is belt tightener in alignment? —— Is there an oil-hole in belt tightener pulley? —— Are doors on leg properly fitted? —— Can motor be oiled without interference? —— Is there a plate over leg to protect electrical equipment? —— Is plate on rear of drive guard stamped and polished? —— Has drive-chain the proper tension? —— Is there a square-head pipe plug in friction-clutch cup? —— Does drive-gear or pulley leak oil? ——

Tailstock

Is top bearing "feeler proof" in relation to base? —— Do set-over screws work freely? —— Is graduation on top for set-over correct? —— Does spindle fit without shake? — Does screw work freely in spindle? — Do binder bushings bear properly on spindle? —— Does tailstock handwheel run true? —— Is screw long enough to knock out center? —— Are clamp bolts the proper length? —— Do clamps clear bed? —— Can tailstock be set over full length of graduations? ——

Carriage and Compound Rest

Is carriage "feeler proof" in relation to vees of bed? —— Does cross-feed screw run true? —— Does bottom slide move freely on carriage from end to end? —— Does compound rest screw move smoothly? —— Are micrometer collars correctly graduated? —— Are T-slots clean? ——

Apron

Has rack pinion proper gear play? —— Does reverse lever operate freely? —— Do friction clutches work smoothly? —— Does the handwheel run true? —— Do half-nuts work smoothly? —— Will rack pinion engage and disengage freely? —— Is lead-screw support in alignment with half-nuts? ——

Feed Mechanism

Does gear-box operate freely? —— Do gears run smoothly? —— Do tumbler gears engage properly? —— Does tumbler slide freely on shaft? —— Do all shifter levers work properly? —— Does quadrant fit properly on gear-box bushing? —— Are change-gears in alignment with quadrant gear? —— Do reverse-plate gears clear spindle gear when set neutral? —— Has reverse plate proper gear play when set? —— Is

lead-screw in alignment with rear bearings? —— Does lead-screw run true? —— Does half-nut engage screw properly? —— Is there end play in half-nut when closed on lead-screw? —— When closing half-nuts, does lead-screw deflect? —— Is chasing-dial worm set central with lead-screw? —— Has it the proper play? —— Will lathe cut all threads index plate calls for? —— Are index and direction plates correct? ——

Toolpost

Does square collar fit compound top slide? —— Does wedge radius conform with concavity in collar? —— Does screw work freely? —— Does wrench fit screw? —— Will proper-size tool fit? —— Will wrench fit all nuts on lathe? —— With tool in post, is it the correct height relative to center of spindle? ——

Follow and Steady Rest

Does follow-rest fit carriage? —— Is center of follow-rest radius central with spindle? —— Do all jaws align with each other? —— Do jaw screws work freely? —— Does steadyrest rest solidly on vees? —— Will rests take their full capacity with the jaws in the extreme outer positions? ——

Turret Tool Rest

Does turret tool rest slide freely on carriage? —— Does it index properly? —— Does it show the proper height with a tool? —— Are all screws a neat and free fit? —— Do wedges fit? —— Is tightener handle set at proper angle? —— Do bearings take oil? —— Is turret tool rest neatly finished? —— Does index-plunger fit properly? —— Does it engage and disengage correctly? —— Is taper gib properly fitted? ——

Turret on Carriage

Does turret slide freely on carriage? —— Is taper gib properly fitted? —— Are holes bored to standard and uniform depths? —— Does the hexagon block index correctly in all positions? —— Does index-plunger work correctly? ——

Turret on Shears

Is bottom slide of turret a good fit on vees? —— Is top slide a good fit on bottom slide? —— Are the two slides neatly scraped together? —— Does pilot move top slide easily? —— Is worm bracket in proper alignment with head and bracket? —— Does feed-rod run true? —— Do feed pulleys run true? —— Are pulleys in alignment with each other? —— Are stop-screws properly fitted? —— Does automatic stop work properly? —— Is hexagon block a good fit on stem? —— Does hexagon block swivel correctly into each position? —— Are holes bored to standard and uniform depths? ——

Taper Attachment

Is taper attachment bracket clamped securely to bed? —— Is swivel bar scraped properly to base? —— Is base graduated correctly? —— Does set-over screw work satisfactorily? —— Will swivel bar swivel full length of graduations without interference? —— Is draw-bar fastened securely to swivel bar? —— Is dog in alignment with draw-bar? —— Does dog fit bed vees? —— Is dog clamp-screw of proper length? —— Is end of this screw polished? —— Is A-bracket in proper alignment with carriage? —— Does cross-feed screw work easily? —— Is taper attachment shoe a good sliding fit from end to end of swivel bar? —— Is shoe scraped properly? —— Does carriage work freely when taper attachment is set to both extreme angles? —— Is yoke in proper alignment? —— Is taper attachment free from backlash? —— Does carriage move freely when shoe slides? ——

Miscellaneous

Is painting good? —— Is paint cleaned from bright work? —— Are all oilers in position? —— Do wrenches fit all nuts? —— Are zero lines correctly located? —— Has agent's name-plate been applied? —— Is general appearance of machine satisfactory? ——

Remarks

Built by ———— Aligned by ————
Inspected by ———— Approved by ————
Date ———— Chief Inspector ————

When the inspector has finished checking a lathe, the foregoing list may be turned over to the assembly foreman, and then given to the "lathe finisher" who is responsible for making the necessary corrections. By glancing at the check marks on the list, this finisher can quickly determine where corrections are required. When the corrections have been made, the finisher should return the questionnaire to his foreman who, in turn, should give it to the chief inspector. A final inspection should then be given to the machine to insure that all desired corrections have been properly made.

An inspection record of every machine built should be kept for future reference in files in the main office of a lathe manufacturing plant. Each record should give adequate information concerning the condition in which the lathe left the plant. For instance, the record should specify the alignment of the various parts, the accuracy of the spindle, the type of drive, the accessories furnished, etc. The record should be filled out after the machine has been approved by the chief inspector, and the latter should be responsible for placing the record on file. An ideal record for this purpose was illustrated on page 199 of November, 1924, MACHINERY. To the items listed on the record there illustrated, the following could well be added:

Electrical Equipment

Make of motor —— Horsepower —— Speed —— Volts —— Phase —— Cycle —— Serial No. —— Style —— AC or DC —— Constant or variable speed —— Did we apply motor? —— Does motor run without vibration? —— Make of controller —— Style —— No. —— Did we attach controller? —— Did controller "run off" machine? —— Additional electrical equipment —— General appearance of machine ——

Although the two lists here given are arranged for lathes only, the reader will understand that lists to serve the same purpose could be conveniently drawn up for other standard machines built by any concern.

* * *

SWEDISH INDUSTRIAL CONDITIONS

According to a report made by Vice Consul T. E. Burke, of Gothenburg, Sweden, the machine tool industry in 1926 in that country was not very successful, foreign competition, long credit terms granted by foreign manufacturers, and reduction in domestic demand being mentioned as the chief adverse factors. A number of plants that came into existence during the war have been forced to close down. On the other hand, some other manufacturing fields have been remarkably successful. Since the outbreak of the war thirteen years ago, the value of exports of ball and roller bearings from Sweden have increased six times, amounting to $6,240,000 in 1926.

In the woodworking machinery field, where Sweden has held an important place among European countries, conditions were not satisfactory. Russia, in prewar years, was an important buyer of Swedish machinery of all kinds, and especially of woodworking machinery, but that country bought comparatively little in Sweden during 1926. The gasoline and crude oil engine business has improved considerably during the year, and a large volume of business was done with France, in spite of German competition.

Value of Exhibits to the Machine Tool User

By R. N. BROWN, General Superintendent, Packard Motor Car Co., Detroit, Mich.

A production man can get more out of visiting a machine tool show than he can out of visiting a competitor's plant, because at the show he can see more types of modern machine tools operating under one roof than in any automobile plant in the country. At the show he will see the very latest products of the machine tool builder's art, and no matter how well he keeps posted through technical journals and conferences with salesmen and engineers representing the machine tool builder, he will find the show a very valuable adjunct in keeping informed on the "last word" in machine tool development.

It is not only seeing the machines in operation that is of value to him—it is the ideas that occur to him as he inspects the various exhibits. In comparing different machines, there is much food for thought. He also trades ideas with other men, and can exchange ideas with more men in a given time than he could anywhere else. No production man could go to one of these shows without taking home ideas that will prove of value in his plant, and all the leading automobile builders have always been well represented at these shows.

The machine tool builder also obtains a great deal of information at a machine tool exhibition. The interchange of ideas with production men aids him in developing his machines to mutual advantage to himself and to the automobile industry. This, perhaps, is the greatest permanent result from expositions of this kind.

Furthermore, the man engaged in automobile production obtains much information at the production meetings held by the Society of Automotive Engineers in conjunction with shows featuring machine tools and other shop equipment. Often, at these meetings, he hears for the first time of some new development in the automobile production field. These shows, therefore, are enterprises that well deserve the encouragement of the industry, and this can best be given by visiting them and profiting by what may be seen there and by the ideas that are obtained through conversations with other men who have similar production problems.

By F. T. ELLIS, Superintendent of Manufacturing, Cadillac Motor Car Co., Detroit, Mich.

Perhaps the chief value of a machine tool and shop equipment show lies in the fact that it promotes the interchange of ideas. All progress in the manufacturing industries is brought about by an interchange of ideas. Men interested in the same general line of work meet, and each contributes a certain amount to the solution of some new problem that faces the industry. The result is cheaper methods of manufacture and, at the same time, a better product.

It is no longer true that a genius gets off by himself in a corner and thinks up some wonderful scheme that will revolutionize the methods of industry. Only on very rare occasions does something like that happen. The most substantial progress in the machine tool industry, for example, is brought about by the association of men who make and men who use machine tools, at which time the user can freely discuss with the maker the troubles that may have been met in the operation of machines formerly installed, and the requirements that will be placed upon the machines of the future.

A machine tool show is also of great value because it enables the user to find all the machines in one place and to compare the merits of different machines used for the same purposes.

To the builder of machine tools the shows should be of equal value. Comparisons with a competitor's product should be the greatest stimulant to further development, and this is as true in the designing and building of machine tools as in any other field. A show easily reveals the comparative merits of different makes of similar machines, not only to the user, but to the builders as well.

A machine tool show enables the builders of these machines to confer on the standardization of various features common to a type or line of machines—tapers, work-holding devices, threads, wrenches, etc. This promotes economy in the building of machines and enables the user to obtain better results at less cost. Such standardization, for example, makes it possible to keep fewer arbors, chucks, and other devices in stock.

In the foregoing, the author has endeavored merely to point out the more essential advantages of machine tool and shop equipment shows. He has found them of great value and believes that they serve a valuable purpose to the entire industry.

By F. J. LAMBORN, Assistant Production Manager, Dodge Brothers, Inc., Detroit, Mich.

There are three outstanding advantages of machine tool and shop equipment shows through which a man responsible for production is benefited.

1. Throughout the year he reads in the journals devoted to shop practice and equipment about the new machines and tools that are being developed by different manufacturers. He is also made thoroughly familiar with these tools through visits of salesmen with whom he comes in contact, but he does not have the opportunity to see all of these new machines under power and engaged in production work. The opportunity to see the machines in operation is afforded by machine tool and equipment shows.

2. He can see in one place and in a comparatively brief time a very large number of machines, tools, and appliances which he could not otherwise observe except by visiting a great many different shops. Hence, a machine tool and shop equipment show saves both time and expense for the mechanical executive responsible for production.

3. Expositions of this kind afford an opportunity to exchange ideas with men from other shops and to learn of their experiences with different types of machines and tools. This is of considerable value in selecting the right machines and tools.

By J. P. LANNEN, Master Mechanic,
Paige-Detroit Motor Car Co., Detroit, Mich.

The writer has attended several machine tool and shop equipment exhibits in the past and believes that the time spent there by any man who is responsible for the selection of shop equipment is well invested. These shows put him in touch with all the latest developments in the machine tool industry, and because the machines are shown in actual operation, he obtains a thorough conception of the possibilities of these machines—a conception that he could not obtain in any other manner. At these shows he has an opportunity to study any machine in which he may be interested and to consider the possibility of adopting this machine to his product.

At these shows a man meets executives and engineers from other manufacturing plants and the resulting exchange of ideas is often a fruitful source of shop improvements. The average man connected with a shop does not have the opportunity of visiting other plants often enough to keep in touch with the latest developments in machinery, and the show is, therefore, often a means of taking him out of his groove and giving him a chance to see all the latest improvements and developments at one time.

The writer has found that a casual trip through an exhibit does not uncover all the possibilities. A man may profitably spend one or more days going over the exhibits thoroughly. During that time many new ideas will suggest themselves that did not come to him on the first casual inspection. The writer heartily endorses machine tool and shop equipment shows to all who are interested in machine tools.

By F. W. STEIN, Superintendent,
Small Engine Division, Fairbanks, Morse & Co., Beloit, Wis.

Past experience has confirmed the belief of the writer that machine tool expositions are one of the best means of becoming acquainted, in a comparatively brief space of time, with the latest and best equipment in the machinery field, especially as it is possible in this way to see the equipment in actual operation, most exhibits being under power. The machine tool exposition gives the mechanical executive an opportunity to see actual demonstrations of the new machines and tools with which he has become acquainted during the year through the editorial and advertising pages of trade journals, and through circulars and catalogues, and the visits of machinery salesmen.

A number of the men responsible for production at our plant have visited such shows in the past and have brought back many new ideas which have helped to increase production and facilitate the handling of work in the shop. The value of such visits cannot be over-emphasized; exhibits of this kind are important to industrial development.

By I. B. SWEGLES, Superintendent of Manufacturing,
Hudson Division, Hudson Motor Car Co., Detroit, Mich.

The writer has visited a number of machine tool and shop equipment shows in the past and considers that these shows are of great value to men in charge of mechanical equipment and production. The machine tool builder has a chance at a show to thoroughly demonstrate his machines to the prospective user, and it is possible for the visiting mechanical executive to see in operation machines built by scores of different manufacturers within a short space of time.

No matter how well informed the mechanical production man may be, he will always see some machines with which he may not be thoroughly familiar, and uses will be suggested to him for other machines that may not have been apparent to him before. It is easier to make comparisons between different makes of machines when they are all exhibited in one place.

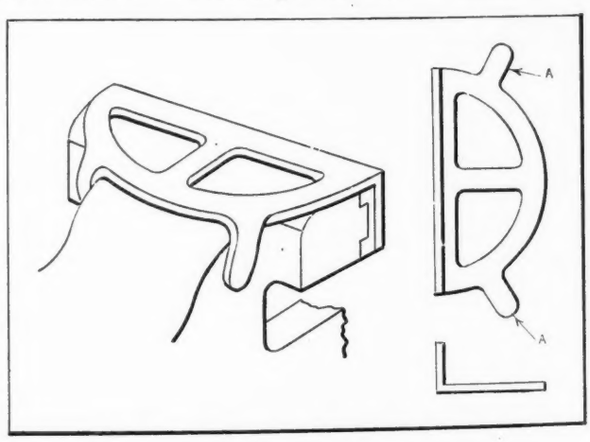
The information obtained from other production men visiting the show is also of great value. Frequently their opinions of machines used in their own plants aid in the selection of suitable machine shop equipment for other shops. The writer has always found these shows well worth visiting, and the cost repaid many times through the information obtained.

* * *

AUXILIARY VISE JAWS

By H. L. WHEELER

An improved type of auxiliary vise jaw which the writer believes is greatly superior to the makeshift liners used in many shops is shown in the illustration. The improved jaw is cast from any soft metal such as copper, bronze, or lead, and a metal pattern is used in making the mold. In one shop, the jaws are kept in stock and issued to the bench hands in exchange for the old ones.



Auxiliary Vise Jaws

When a number of old jaws have accumulated, they are returned to the foundry and used in making a new supply. In fitting a pair of jaws to a vise, the first step is to clamp them tightly in place by closing the vise. The projecting lugs *A* are then bent back over the jaws of the vise, as shown in the view at the left-hand side of the illustration. Auxiliary jaws made and applied in the manner described stay in place much better than the straight sheet-metal type.

The British Metal-working Industries

From MACHINERY's Special Correspondent

IN the metal-working industries, generally, it appears that the vacation season slackness has begun somewhat earlier and is rather more pronounced than usual. The unemployment figures, which are once again above the million mark, cannot be regarded optimistically, but it is safe to predict that the total will be substantially reduced as business resumes its normal course in the fall.

Machine tool builders are by no means well employed, particularly in the Lancashire and Yorkshire districts. Some firms are obtaining inquiries for special types of machines, and there would seem to be an improvement in the demand for screw machines, but for heavy drilling machines and lathes, orders are hard to obtain and prices far from satisfactory. Manufacturers in the machine tool industry may, however, console themselves with the reflection that several of the industries that are their most important customers are showing greater activity than for many months, and orders for new equipment must materialize eventually.

Overseas Trade in Machine Tools Improves

The general effect of the June returns of overseas trade is to improve the average shown by the previous five months. In tonnage and value, the exports are higher and the imports lower. In ton-value the exports continue to fall and the imports to keep up. June shows that the year may turn out better than was anticipated from its bad start.

The exported tonnage of machine tools rose from 1111 tons in May to 1449 tons in June, with a corresponding increase in value from £127,746 to £156,797. At the same time the ton-value fell to £108, as compared with the April and May figures of £126 and £115, respectively. The import figures for June show a sharp decrease from the May figure of 824 tons to 536 tons; the fall in value was, however, disproportionate, namely, from £97,218 to £86,607, with the result that the ton-value rose from £118 to £161. The exports of small tools and cutters show very little change in value in June, being £55,519, compared with the May figure of £56,803.

If the returns for the first six months are accepted as an indication of the exports of the current year in comparison with the previous year, then they will be substantially the same in tonnage and slightly better in value.

Shipbuilding Industry is Fairly Well Employed

Great Britain and Ireland can hardly have been said to have participated in the record set during the quarter ending June 30, since although for the first time the world returns for tonnage building showed an excess of motor over steam ships, in our own case, the motor tonnage under construction, namely, 627,700 tons, was only 82.8 per cent of the total steam tonnage under construction.

The present total, although the highest since September, 1924, is still 500,000 tons below the average tonnage building during the twelve months immediately preceding the war. A considerable decrease was shown in the tonnage commenced during the June quarter, namely, 437,112 tons, as compared with 579,839 tons during the first quarter of the year. A number of contracts have recently been booked, and by comparison with many other fields, the shipbuilding industry may be said to be in a most fortunate position.

The Automobile Industry Experiences Seasonal Slackness

Motor vehicle manufacturers continue, on the whole, to be well employed. In some cases, the demand for pleasure cars is reported as unsatisfactory, but a falling off in orders is almost inevitable at the present time, and some slackness is likely to be felt until the opening of the Motor Show at Olympia. There is, however, a steady demand for commercial vehicles, for six-wheel trucks, and for heavy buses.

Locomotive Plants Expect South African Order

Locomotive builders will be cheered by the news that the South African Railways Administration is shortly to invite bids for the largest number of locomotives ever ordered at one time for the Union. The majority of the locomotives, it is understood, will be of large dimensions for use on the main lines, but a considerable number of smaller types will also be required for branch service. Evidence is not wanting that the large railway companies realize that renewal activity on their part is necessary if the growing competition of road transport is to be held in check. It is significant that a luxury motor-coach service between London and Bristol has been started. On this service meals are served in the coaches, and this would appear to be the first definite attempt on the part of owners of motor vehicles to strike at the monopoly hitherto enjoyed by the railways in the matter of high-class long distance passenger service.

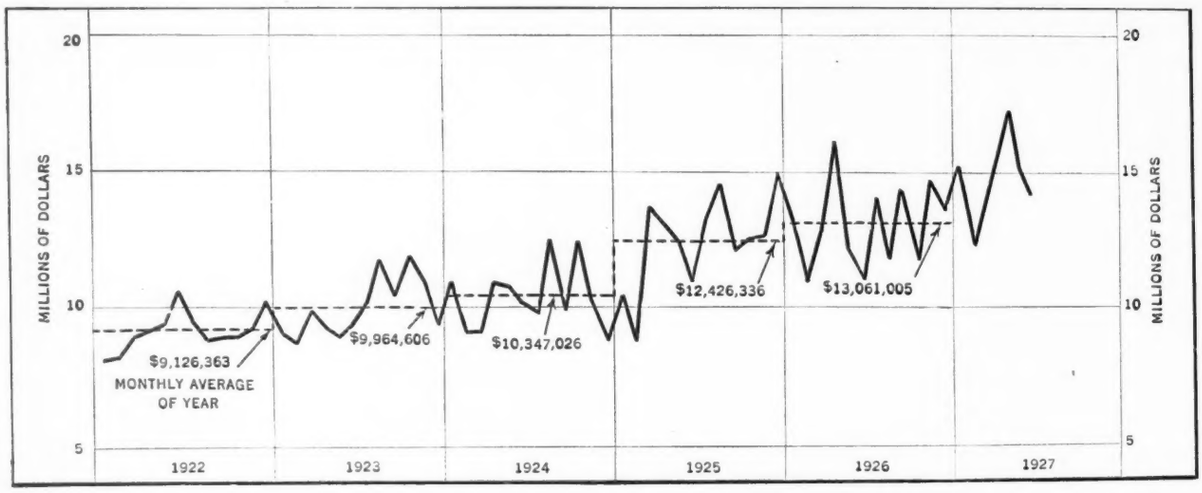
Constructional engineers, on the whole, are fairly well employed. Electrical engineering continues to be the brightest section in the industry, and many substantial orders have been booked during recent weeks. An encouraging feature is the number of inquiries being received from overseas. From these contracts, Sheffield engineering firms are deriving much benefit, since local steel is being used largely in their execution.

Recent reductions in the price of pig iron and coke have brought about important cuts in the price of steel. Although continental competition is still very keen, the activity prevailing at furnaces indicates that some success is attending efforts to replace existing contracts. Railway steel is in demand, but continental competition is acute.

The Machine-building Industries

THERE has been no appreciable change in the general business situation during the past month. Since the middle of July there has been an upward trend in some industrial fields, especially in the automobile industry, while the iron and steel industry has declined. Among important developments should be noted the fact that crop reports are more favorable than was anticipated, and that chain and mail order businesses report increased sales, indicating general prosperity throughout the country. Among the unfavorable factors may be mentioned the fact that freight loadings continue below those of a year ago, and that the total volume of trade in all fields appears to be at the lowest point for this year.

The strength shown by the activity in the building field is a surprise to many. The July construction contracts awarded in thirty-seven states east of the Rocky Mountains, as reported by the F. W. Dodge Corporation, are 3 per cent in excess of those for last year, although they are considerably below the record-breaking figures for June. Up to the present time, these construction contracts are 2 per cent above the 1926 figures.



Department of Commerce Chart of Exports of Industrial Machinery from the United States

The Iron and Steel Industry is Less Active

The iron and steel industry is less active than it has been at any time since July, 1925. The United States Steel Corporation operates at between 65 and 70 per cent, and the industry as a whole is probably not operating at more than from 60 to 65 per cent of capacity. There has been an improvement in structural steel demand, and there is some gain in the unfilled finished steel orders on hand. It is expected that the output in August will be approximately the same as in July, which will be considerably below the output a year ago, when the largest August output on record was reached.

Machine Tools and Industrial Machinery

There has been no marked change in the demand for machine tools, August buying having been approximately at the same level as in July, which did not differ very much from that of the two preceding months. A large order for a South American railroad is reported, amounting to about $500,000 worth of machine tool equipment. This is probably the largest single machine tool order placed for a year or more, and it is the largest single order received by the company that obtained it in six years.

In the general industrial machinery field, there is satisfactory activity, with exports steadily at a higher level than last year. The exports for June, statistics of which have just become available, totalled over $14,000,000, and represented an increase of more than $3,000,000 over the corresponding month of 1926. The exports for the first half of the year amounted to $87,750,000, as compared with $76,250,000 for the corresponding period in 1926. The accompanying chart indicates that this improvement in the machinery export trade, as reported by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, has been going on steadily since 1922.

Of the exports in June, metal-working machinery amounted to $1,900,000 as compared with $1,380,000 for the corresponding month last year. During the first six months, the exports of metal-working machinery amounted to $11,050,000, as compared with $9,260,000 last year.

The Automobile Industry Shows an Improvement

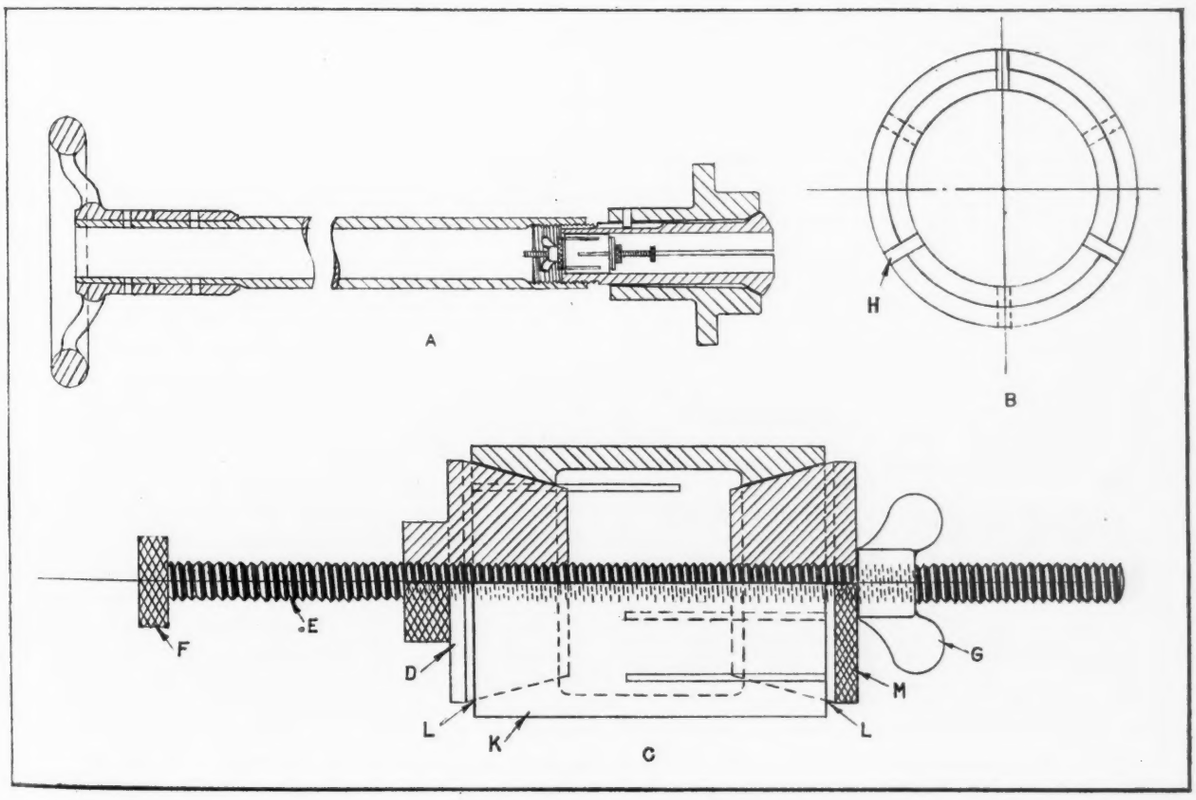
There has been a decided improvement in the automobile industry, and several of the companies who have recently brought out new models are increasing their production schedules. When the figures for August become available, it is expected that they will show a decided increase both in production and in sales over June and July. Nash and Hudson both report the biggest July in their history, and General Motors, as usual, has been doing a very satisfactory business. *Automotive Industries* places registrations on July 1 at 20,744,197, which is 6 per cent more than for the same date a year ago.

Letters on Practical Subjects

WORK-STOP FOR LATHE AND SCREW MACHINE COLLETS

In machining metal parts on a hand screw machine or an ordinary lathe, it is sometimes difficult to gage the length of the part, for the reason that no provision is made for determining how far the work is inserted in the collet. As a result, the parts are not held to uniform lengths. To overcome this difficulty, the adjustable stop shown in the accompanying illustration was provided. This stop is designed to be clamped on the rear end of the collet, so that when a part to be machined is inserted, it will rest against the stop. All the parts machined will then be of uniform length. An adjustable stop of this kind will be found useful both for cutting off work to a given length and for machining shoulders or recesses at or near the outer end of the part.

At *C* is shown an assembly or cross-section view through the center of the adjustable stop. The expanding body *K* has a tapered hole *L* at each end. The expanding body also has three saw slots *H* in each end, as indicated by the view at *B*. These slots allow the body to be expanded against the wall of the collet. The expanding nuts *M* and *D* are tapered to fit the tapered holes *L* in the body. Nut *M* is knurled on the end, and when turned by hand on screw *E*, causes the body *K* to expand. Screw *E* is provided with a head or stop *F* which is knurled to permit it to be easily adjusted in or out as required. After adjusting stop *F*, nut *M* is tightened, causing body *K* to expand inside the collet, where it is locked in position by the nut *G*. The setting of stop *F* can then be adjusted at any time by simply loosening lock-nut *G* and turning screw *F* in or out the required amount.



Work-locating Stop for Collet

Referring to the view at *B*, it will be noted that the three slots in each end of the collet are staggered. The view at *A* shows the stop in place in a collet. It will be noted that the stop is so designed that it does not interfere in any way with the draw-bar or with the operation of the collet. Stops of the design shown can be made in different sizes to fit the various sizes of collets in use.

Rochester, N. Y. BERNARD J. WOLFE

DIE FOR PRODUCING HUNTING TOOTH GEAR

The punch and die shown in Fig. 2 is employed in the production of two-tooth hunting gears like the one shown at *A* in Fig. 1. Gears of this type are commonly used in mechanical accounting devices. The die is of the progressive type, having three positions which are shown in the cross-section views in Fig. 1. A complete gear is produced at every stroke of the press after the stock is once started. The stock is first fed against the spring pin *T*, Fig. 2, which serves as a stop. Piercing punch *B*, section *X–X*, Fig. 1, shears through the stock, forming the center hole in the gear, and holds the work while forming punch *C* forces down the depression in which the gear teeth are to be formed. The forming punch *C* works against the action of spring pin *D*. The length of pin *D* is such that when it strikes the hardened bumper *E*, it will be properly located to form the depression to the exact measurements required.

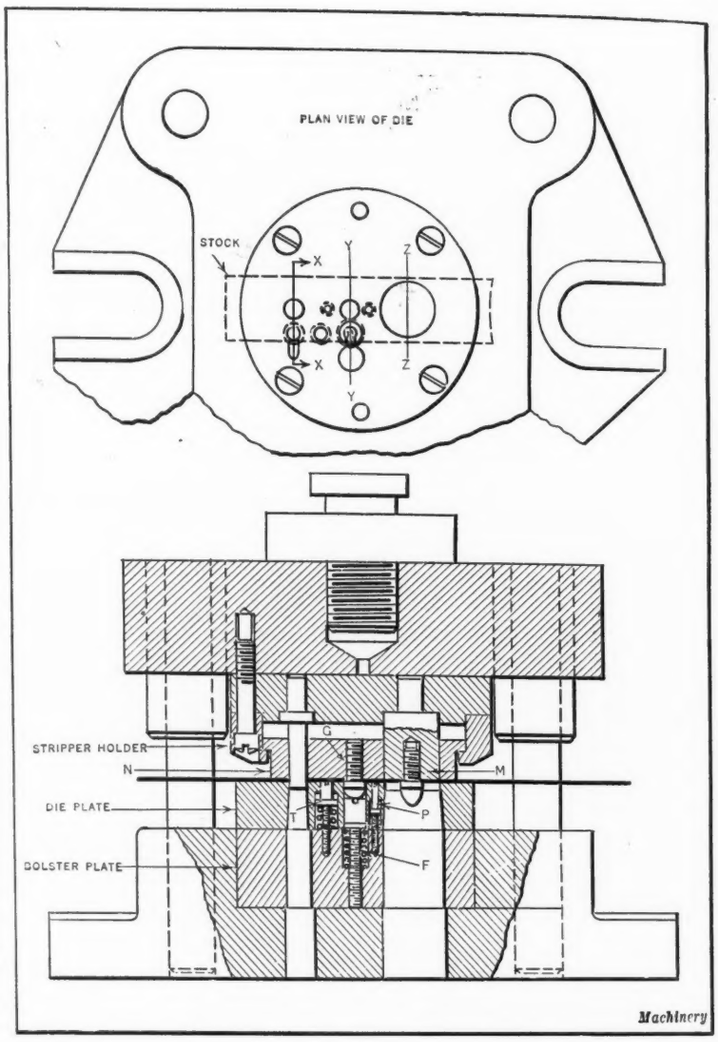


Fig. 2. Die for Producing Gear Shown at A, Fig. 1

The stock is next advanced over the stop spring pin *T*, Fig. 2 (which also serves as an ejector) until the pierced hole in the strip drops over the spring pilot pin *F*. The next operation is then performed by the punch and die shown in section *Y–Y*, Fig. 1. This operation consists of forming the gear teeth. To insure obtaining the necessary accuracy, a solid pilot pin *G*, located in the punch plate descends into the pierced hole, forcing down the spring pilot pin *F*, Fig. 2, and holding the work solidly in place during the operation. The gear teeth are formed by the punch *H*, Fig. 1, and the die bushing *J* in which the depression previously produced is located. Punch *H* sometimes carries back the punching produced in forming or piercing the teeth. When this happens, the ejector *K* incorporated in punch *H* forces the punching back through the die and out through the hole shown in the die-plate. The stock next goes to the final station, being located by the pin *F*, Fig. 2, which fits into the pierced hole. At this station, shown by the cross-section view *Z–Z*, Fig. 1, the gear is blanked out by punch *M* piloted by pin *L*.

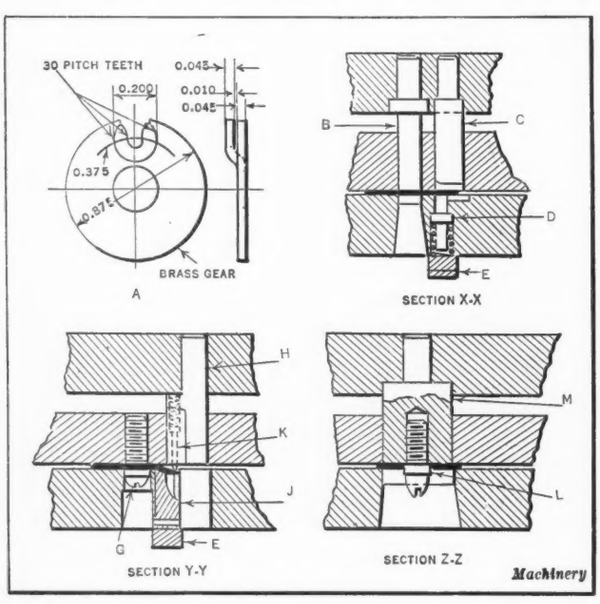
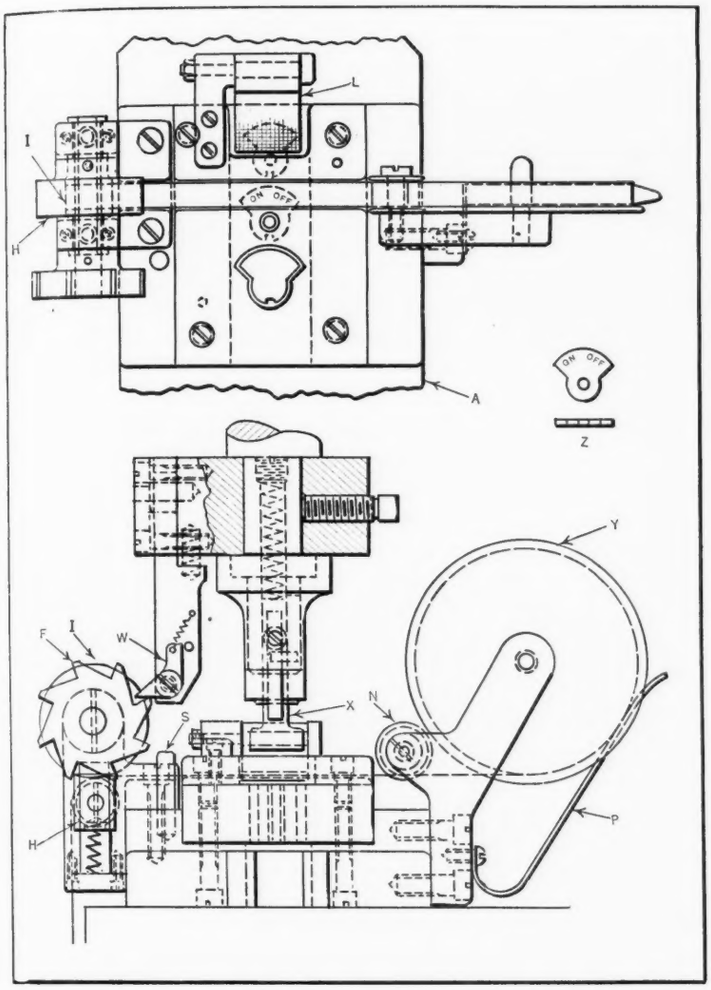


Fig. 1. Brass Hunting Tooth Gear, and Three Die Stations which Pierce, Form and Blank the Gear

Throughout all the operations, the stock is kept down on the die by the stripper *N*, Fig. 2, which is forced down by four springs (not shown in the illustration). It will be noted that the ejector pins *T* and *P*, as well as the stop-pin *F*, have threaded shanks which can be screwed into corresponding holes in the bolster plate. The slots in the top of these pins permit a screwdriver to be used for this purpose. The screwing down of the stop-pins permits the surface of the die to be reground without interfering with the heads of the pins.

Bronx, N. Y. B. J. STERN



Stamping, Piercing and Blanking Die for Fiber Part

DIE FOR STAMPING, PIERCING AND BLANKING FIBER SHIELDS

In the accompanying illustration, is shown a die used in the manufacture of fiber shields like the one shown at *Z*. These shields are used in the construction of electrical switches. The old method of producing the shields was first to pierce and blank the fiber member in a power press and then stamp the lettering in a foot press. This operation was performed by laying the blank in a nest, dampening it with a sponge, and then holding a sheet of white paper, gummed on the bottom side, directly under the descending stamp.

The die shown is mounted in a power press, and has increased production approximately 85 per cent. The operation is comparatively simple. The fiber strip is fed into the die, and as the ram of the press descends, the pad *X*, which is directly over the position that the letters will occupy on the next movement, presses on the water-soaked flat wick *L*, and thus dampens the stock.

At the next stroke of the ram, the pawl *W* imparts motion to the ratchet wheel *F* and rolls *I* and *H*. This action serves to pull the gummed paper strip on drum *Y* across the die. The flat spring *P* keeps a uniform tension on the paper strip, and roll *N* guides it across the die at the proper height. Just before the stamp comes in contact with the strip, the stop *S* causes the roll feed to dwell during the remainder of the downward stroke, thus preventing any undue tension which might cause the paper to be torn from the strip.

The stamp cuts through the paper and forces the letters down upon the damp fiber, and as the paper has a coating of gum on the under side, the letters adhere to the fiber piece. The fiber shield which has thus been stamped is blanked out at the next position and drops through an opening in the die. After starting the fiber strip, it is drawn through the die by an ordinary roll feed at the right of the press (not shown in the illustration). The blanking punch is of the usual construction, and hence is not shown in the illustration. The wick *L* is kept supplied with water or moisture by drip-cans, such as are used for feeding cutting oil to milling cutters.

Bridgeport, Conn. J. E. FENNO

LAYING OUT CAMS FOR AUTOMATICS

In laying out a set of cams for a Brown & Sharpe automatic screw machine, the amount of cam surface to allow for indexing can be readily determined by employing a diagram like the one here illustrated. Use of such a diagram will eliminate the danger of providing too small an allowance when making a lay-out on paper, as sometimes happens when only the standard allowance is made. A diagram like the one shown in the illustration can be easily scribed on a sheet of brass or tin and kept for ready reference. By laying the templet having the standard drops and rises over the diagram and placing a metal disk of the same diameter as the cam roll in contact with the templet, it can be seen at a glance just how much space will be taken up by the roll in any combination of rise and fall.

South Meriden, Conn. D. F. MORIARTY

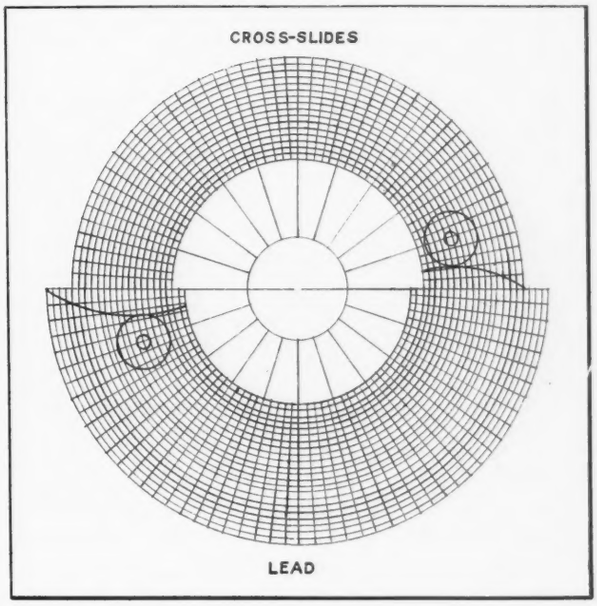


Diagram Used in Laying out Cams

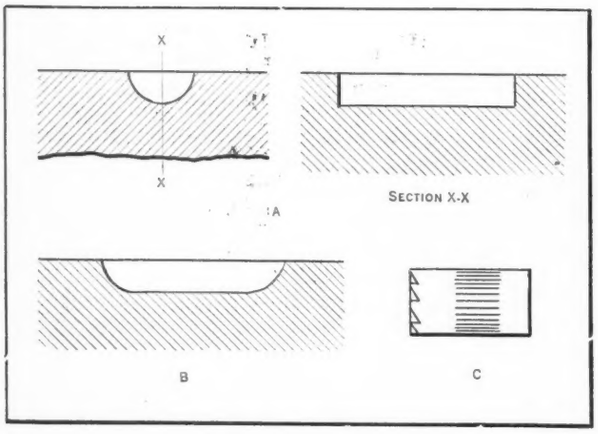


Fig. 1. Recess in Molding Die

MILLING SQUARE-END SEMI-CYLINDRICAL RECESS

A departure from the ordinary methods of machining is often necessary in tool-room work. Perhaps the making of molds from bakelite and similar materials presents more difficulties than any other class of work. Unfortunately, the designers of the molds for products made from these materials think chiefly in terms of the finished product and leave the construction of the dies to the tool-room foreman.

Recently the writer was connected with a firm that specialized in the manufacture of gages, molds, and similar work. Many of the orders received by this company were for work of so complicated a nature that it was not attempted in the tool-room of the company requiring the work. The particular job described here at first appeared to be very difficult, but it was solved in an interesting and efficient manner by our shop foreman. The unusual machining method employed will doubtless be of interest to many readers.

At *A*, Fig. 1, are shown cross-sectional views of a recess to be machined in a steel mold. As will be noted it is simply a square-end semi-cylindrical recess. The difficulty in machining the recess, however, is encountered in forming the sharp square ends. The first step was easily accomplished by employing a spherical shaped end-mill, which produced the round-end recess shown at *B*. For squaring the round ends of the recess, the toolmaker made a small end-mill like the one shown at *C*. This tool was placed in the recess and driven, in the manner shown in Fig. 2, by a gear *D* mounted on the arbor *E* of a milling machine. The table of the milling machine was raised so that the gashed teeth in the end-mill meshed with the teeth in gear *D*. The flange *F* mounted on the arbor with gear *D* served to back up and feed the end-mill. With the equipment described, it was a simple matter to mill the ends of the recess to the required shape.

London, England — BERNARD BROWN

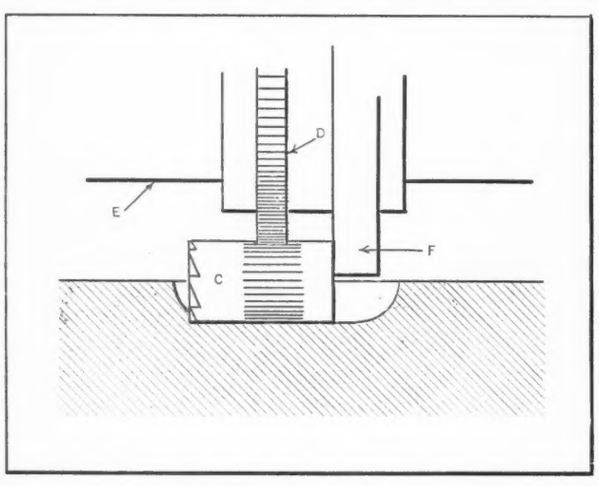
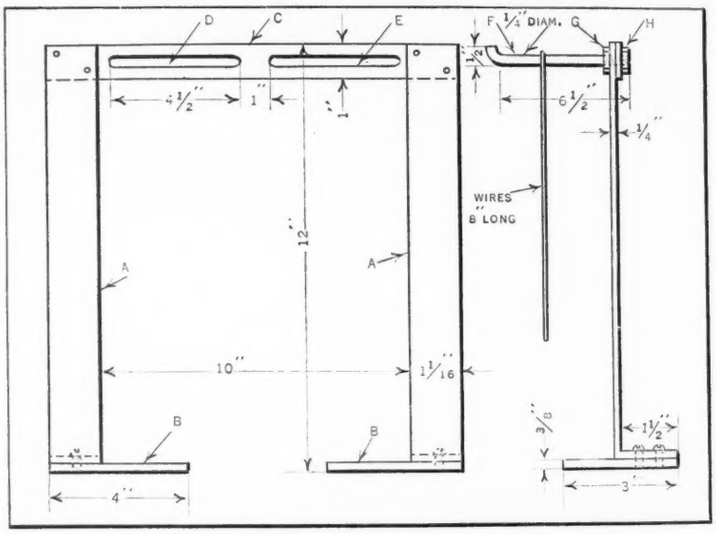


Fig. 2. Method of Milling Square-end Recess

HOLDER FOR THREAD MEASURING WIRES

In cutting screw threads on a lathe, it is sometimes necessary to check the diameter of the thread by the three-wire system without removing the work from the machine. In order to facilitate measuring the threads in such cases, a holder like the one shown in the illustration was constructed. This holder can be adjusted to support the wires in the proper position for measuring the pitch diameter of the thread with a micrometer.



Holder for Thread Measuring Wires

The holder shown in the illustration is used on a 14-inch lathe. For a larger or smaller lathe, or one of different construction, it would probably be necessary to modify the dimensions somewhat. The holder consists of two flat cold-rolled strips *A*, bent at right angles on one end and secured to bottom plates *B*, and tied together at the top ends by the strap *C*. Strap *C* has two slots *D* and *E*, in which pins like the one shown at *F* are secured by nuts *G* and *H*. The ends of the pins *F* are bent up in order to retain the thread measuring wires. The measuring wires are made about 8 inches long, with loops at one end which are a loose fit over the pins *F*. A set of three wires is required in measuring the diameter of the thread, two wires being placed on one pin and one on the other.

The wires for measuring the threads are made up in sets, three wires to each set. For the work on which the holder shown was employed, three different sets of wires were required. The wires in one set were 0.040 inch in diameter, those in

another set 0.0625 inch in diameter, and those in the third set, 0.01 inch in diameter. After placing a set of wires on the pins and adjusting them the proper distance apart, the holder is simply set on the lathe shears, and the measurement taken over the wires in the usual manner.

Philadelphia, Pa. F. SELL

CAM-TURNING ATTACHMENT

A lathe equipped for turning the grooves in face-cams, instead of milling them with an end-mill, as had previously been done, is shown in Fig. 1. The body of the cam, shown at *C*, Fig. 2, is cast iron with a hardened steel cam section *D*. The groove for the roller is turned from the cast iron.

The attachment is shown at *E*, Figs. 1 and 2. The angle-plate *A*, Fig. 2, carries a pivoted lever *B*, which has a hardened pin *F* at its upper end. A hardened pin has been found superior to a roller for this purpose as the contact surface has a smaller radius. A roller also has the disadvantage of soon becoming clogged with chips and dust. The position of lever *B* can be adjusted by means of screw *G*. The attachment is secured to the cross-slide of the lathe in the position shown in Fig. 1. The cam *C* is mounted on the arbor *H*. The cross-feed nut is loosened, so that the cross-slide is free to move in its ways. The spring *J* exerts a pull on the cross-slide, which keeps the pin *F* in contact with the cam section *D* when the cam is revolved. The width of the groove is controlled by the adjusting screw *G*, Fig. 2, which changes the distance between the pin *F* and the cutting tool. The compound rest is set parallel with the centers, the cut being taken by turning the compound rest feed-screw by hand. The set-up, as seen from the head-stock end of the lathe, is shown at *K*, Fig. 1.

Although the groove will be turned slightly narrower on the "rise and fall" portions of the cam, the variation is so slight as to be negligible in this case. This slight variation is due to the fact that the point of contact of the cylindrical pin *F* on the cam does not follow a straight line connecting the centers of the cam and the pin, as does the tool point. The results obtained with the attachment described have been satisfactory and the attachment has more than paid for the cost of construction.

Philadelphia, Pa. R. H. KASPER

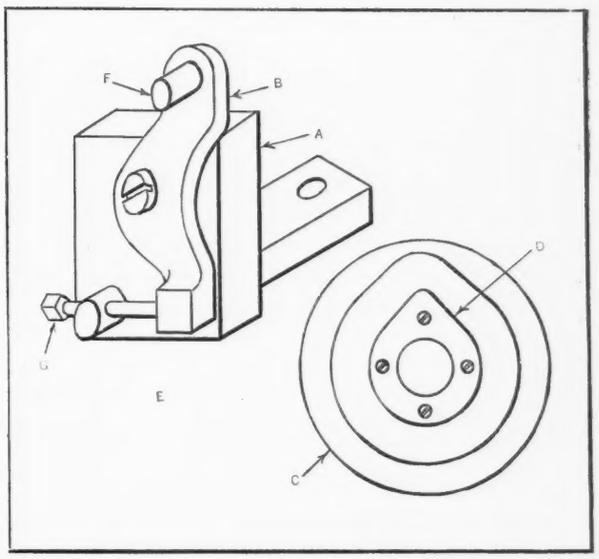


Fig. 2. Cam-turning Attachment and Cam

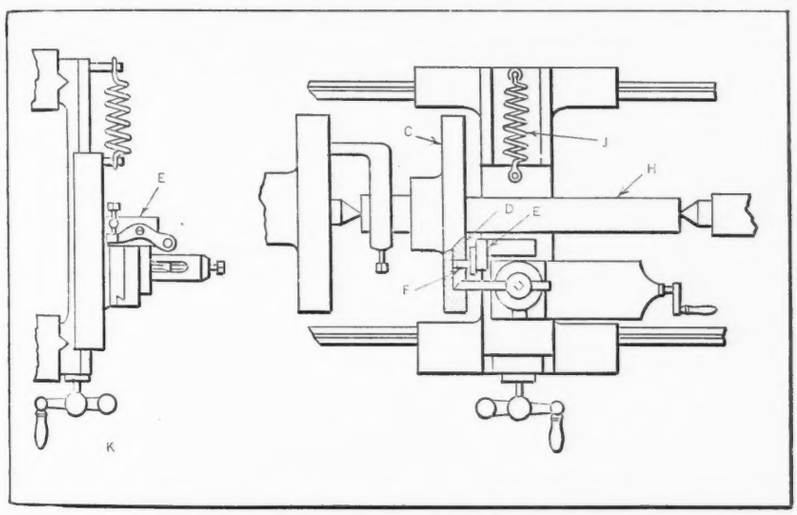
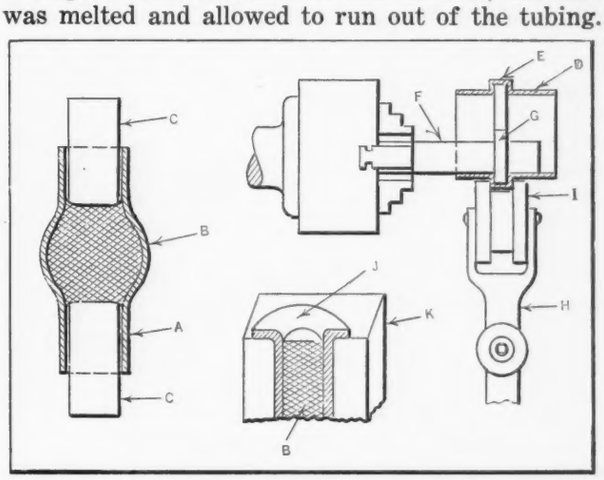


Fig. 1. Lathe Equipped for Turning Cam

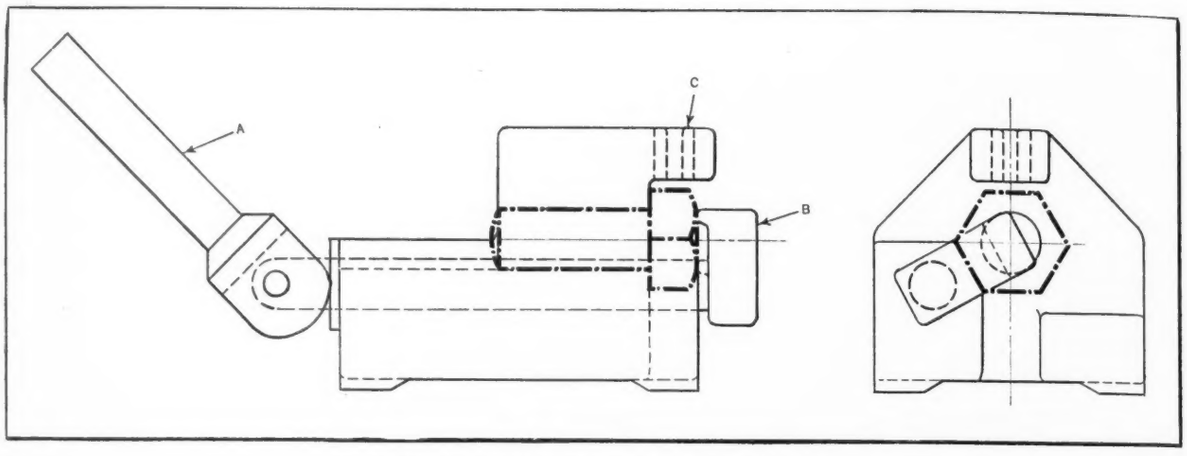
BULGING AND FLANGING COPPER TUBING

The writer has often been confronted with the problem of bulging and beading copper and brass tubing by hand tool methods in cases where there was not a sufficient quantity of work to warrant the making of punches and dies. Some of the methods used to produce the required results are described in the following.

At *A* is shown a piece of tubing after a bulge was produced at *B* by means of simple hand tools. First, molten lead was poured into the tubing, after which the two pieces of machine steel *C* were inserted at the top and bottom of the tube. The lead was made to bulge the tube by resting one piece of steel *C* on an anvil and pounding on the other piece *C* with a hammer. After producing a bulge of sufficient size in this manner, the lead was melted and allowed to run out of the tubing.



Methods of Working Copper Tubing



Jig Used in Drilling Cross-holes in Bolt Heads

At *D* is shown a cross-section of a piece of tubing after a gutter *E* had been formed by tools mounted on a lathe. The mandrel *F*, which is held in the lathe chuck, has a collar *G*, of the size required to produce the gutter *E*, turned on its outer end. The tool *H*, mounted in the toolpost of the cross-slide, has a roller *I* in which there is a groove that fits the outside of the gutter *E*. When the plain piece of tubing is placed over the arbor *F* and the tool *H* fed in, the frictional contact set up with the rotating arbor *F* causes the work and the roller *I* to rotate. The continued inward movement of the tool *H* results in forming the gutter *E* to the required shape.

At *J* is shown a cross-section of the end of a piece of tubing after a flange has been formed on it. The procedure in forming a neat appearing flange of this kind is as follows: First, obtain a block of iron or steel *K*, and after drilling a hole through it, split the block into halves and use these as a clamp for holding the tubing in a vise. Next, pour lead *B* into the tubing gripped between the two pieces *K*.

When the lead has solidified, the shaping of the flange can be commenced. A conical-shaped punch is used first to cause the end to flare out, after which a hammer is employed to complete the shaping of the flange. The lead *B* and the blocks *K* prevent the tubing from becoming distorted. Before attempting to form tubing, it should always be annealed by heating to a red heat and plunging in water.

Philadelphia, Pa. CHARLES KUGLER

DRILL JIG FOR CROSS-HOLES

An inexpensive drill jig for use in drilling cross-holes in the heads of hexagonal-head bolts is shown in the accompanying illustration. The same construction could be employed for square-head bolts, provided the locating surface is properly modified. The bolt to be drilled is shown by heavy dot-and-dash lines.

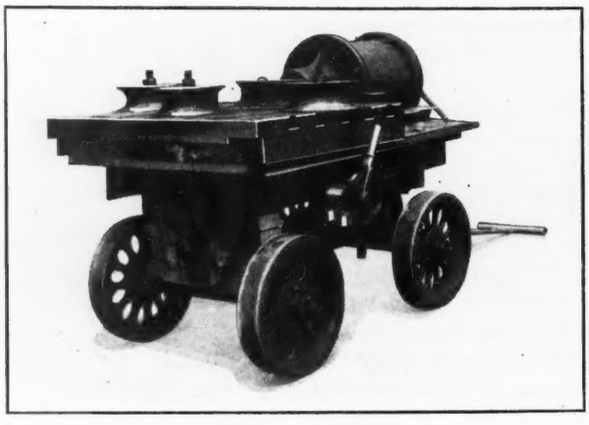
To load the jig, the clamping handle *A* is thrown over to one side, so that the bolt can be put in place. The handle is then turned back to the upright position so that the clamp *B* is in contact with the head of the bolt, after which a backward movement of lever *A* serves to tighten the clamp on the head of the bolt. The bolt head is then drilled in the usual manner, the drill being guided by the bushing at *C*.

Rochester, N. Y. EDWARD T. HEARD

PIPE-BENDING MACHINE

In the accompanying illustration is shown a pipe-bending machine erected by the shop foreman at the Garrett shops of the Baltimore & Ohio Railroad. As the illustration shows, the machine is of the portable type, mounted on a four-wheel truck of ordinary shop size. The base is made from an old shaper bed, in the slots of which are mounted three rollers or dies. The rollers are adjustable, and are suitable for bending work of various sizes. The power is furnished by a standard 12- by 12-inch air-brake cylinder controlled by an engineer's brake valve.

While adaptable for bending pipes of any size, the machine is particularly suited to bending arch tubes. Formerly about three hours time was required to bend a set of tubes by hand, using the heating, bending, and cooling process, and the work was done by a mechanic and laborer. With the new machine, a set of tubes can be bent in less than twenty-five minutes without crimping the pipe. It is claimed that the work produced by the machine is much better than that obtained when the pipes were bent by hand. The new machine also performs the work in about one-sixth of the time formerly required. A further advantage is that the machine is constructed at a low cost, and the operating expense is practically negligible.



Pipe-bending Machine

N. C. MCLOUD
Baltimore, Md.

Questions and Answers

STANDARD UNIT OF MEASUREMENT

H. O.—Is it true that the inch as a standard unit of measurement is different in the United States and in Great Britain?

A.—There is an unfortunate difference in the relation between the standards of measurements as defined in the United States and Great Britain, but the difference is so small that it is of no importance in ordinary mechanical work, as it amounts to only 1/363,000 inch in one inch. The difference, however, becomes of importance in the more precise length measurements of science and industry, where accuracy of 1/1,000,000 of an inch or even higher, may be required. The Bureau of Standards, in a publication entitled "A Fundamental Basis for Measurements of Length," by H. W. Bearce, Senior Physicist, published as Scientific Paper No. 535 of the Bureau of Standards, states the matter as follows: "There is at present a slight difference in the official relation between yards and meters in the United States and in Great Britain. In the United States, the official relation is:

$$\frac{1 \text{ yard}}{1 \text{ meter}} = \frac{3600}{3937}$$

"In Great Britain the official relation is:

$$\frac{1 \text{ yard}}{1 \text{ meter}} = \frac{3600}{3937.0113}$$

"From these relations may be derived the following approximate relations:

1 United States inch = 25.40005 millimeters
1 British inch = 25.39998 millimeters"

In order to avoid these discrepancies, the bureau recommends that the meter be defined in terms of wave lengths of light from cadmium vapor, and that the simple relation of 1 inch equals 25.4 millimeters be adopted universally wherever the English or the metric systems are used. If this relation is adopted as exact, then the corresponding relation, 1 yard equals 0.9144 meter, will also be exact.

CLASSIFICATION OF PIG IRON

A. L.—Are different grades of pig iron, such as is used in foundries, etc., classified according to composition or with reference to the intended use?

A.—Pig iron is classified according to (1) the method of manufacture; (2) its intended use; and (3) its composition. The methods of manufacture produce: (1) coke pig iron, which is smelted with coke and always with a hot blast; (2) charcoal pig, which is smelted with charcoal and either a hot or cold blast; (3) anthracite pig, smelted with anthracite coal mixed with coke, using a hot blast. Classifications according to intended use are: (1) Bessemer pig, used for the Bessemer and acid open-hearth processes of making steel; (2) basic pig, used for the basic process; (3) malleable pig, used for malleable cast-iron castings; (4) foundry pig, used for foundry work; (5) forge pig, an inferior grade used for puddling and some classes of foundry work. The grading according to composition was formerly done by breaking the pig and examining the fracture; the modern method is by chemical analysis. In the United States, pig iron is usually sold in tons of 2240 pounds. It contains about 93 per cent of pure iron, from 3 to 5 per cent of carbon, and some silicon, phosphorus, sulphur, etc.

IF MINOR IS EMPLOYED WITHOUT PARENT'S CONSENT IS EMPLOYER LIABLE?

I. I. P.—Having been informed that a boy or workman under legal age may be employed without the employer being liable for injuries or death of the employe, I should like to know the general law on this question, particularly when the minor is hired without the knowledge of his parents.

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

An employer is always liable for his negligence as a result of which an employe is injured; but in respect to a minor, it has been held that if a minor is employed without the parent's consent and the employer later is given permission to retain the minor at the work, the employer may be relieved of liability for injuries received thereafter provided, of course, the injuries are not the result of the employer's fault or neglect.

Also, there are other circumstances under which a minor may be employed without the parent's consent, and the employer is not liable for injuries sustained any more than if an adult were injured. For example, when it was proved that a father lived within a few miles of a plant in which his son worked at dangerous employment and that the parent had knowledge of the employment but failed to object during the eight weeks time the son performed his duties before he was killed, the Court held that the father had implied his consent to the son working in the dangerous occupation by not directly objecting to it, and since the accident occurred because of the minor's negligence, the company was not liable.

In another case, where a father had knowledge that his minor son was working in a mill, it was held that the father was not justified in recovering damages for injuries that were later received by the son. The Court pointed out that the parent should have objected to the employment if he was not satisfied.

WELDING CRACKED CYLINDERS

A. S. C.—Is there any method by which automobile cylinders that are cracked as the result of freezing can be welded without preheating? We have tried several methods, including brazing with bronze and welding with nickel rod. An alternating-current electric arc welder has also been used, but with little success.

Answered by C. P. Topping, North Tonawanda, N. Y.

A.—A number of years ago I had the misfortune to have a six-cylinder engine freeze up. The block cracked in five places. A neighboring garage wanted $100 to weld it, but it cost me just 10 cents and about one half hour of my time to repair it by using a cement made of salammoniac and iron filings pressed into the cracks.

Small cracks can be stopped by dissolving a good quantity of salammoniac in water and placing the solution in the cooling system. After allowing time for the salammoniac to rust tight in the cracks, wash out the cooling system thoroughly with hot soda water. By this method the engine can be repaired without pulling it down, and better still, the engine will not be ruined by heating.

Answered by A. Eyles, Manchester, England

In order to obtain the best results in welding cracked automobile cylinders, total or partial preheating is essential. Attempting to weld a badly damaged or cracked cylinder without preheating it would very likely result in breaking the casting, due to expansion when the torch is applied and contraction when the weld cools.

Modern autogenous welding methods make it posible to satisfactorily repair cylinders that only a few years ago would have been deemed entirely irrecoverable. Cylinders that have had their heads blown to bits, with parts missing and their bores scored or badly cracked, can be repaired so that they are equal to new, provided the work is carried out by experts familiar with modern welding technique and aided by the use of correct materials.

With regard to preheating, experience is required to decide whether the cracked cylinders should be totally or partially preheated. Each job should be carefully studied for the purpose of estimating the effects of expansion and contraction. If total preheating of the cylinder casting is necessary, the welder should utilize the best method at his disposal, as the strength of the welded joint absolutely depends upon a thorough, even, and slow heating and cooling.

The most common form of preheating is by the charcoal fire. Good hardwood charcoal is the best fuel for this purpose. A furnace built with firebricks to the shape of the cylinder casting, with the bottom bricks set apart a few inches to give sufficient draft and the necessary room for turning while hot, is the most effective.

The charcoal will burn steadily, and with proper attention, will bring the cylinder casting up to the desired heat for welding. The temperatures required range from a blue heat to a dull red. After the weld is made, the fire can be replenished, the casting reheated evenly, and allowed to cool down very slowly. This is essential in order to insure a satisfactory repair. Obviously, the actual welding operation depends upon the ability and resourcefulness of the welder.

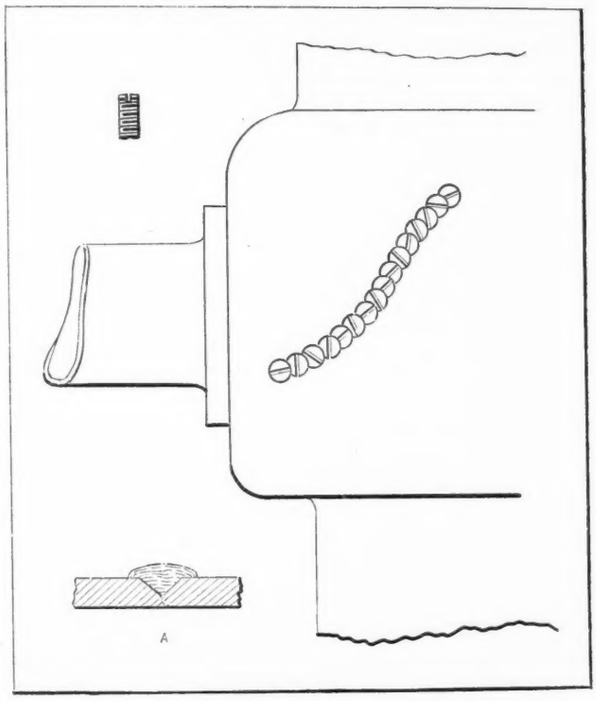
Should the combustion head be cracked, it is generally necessary to cut away part of the water jacket wall to reach the fracture. When this has been done, the piece of metal cut away is replaced and welded in position.

In regard to the employment of bronze filling material for the welding or brazing of cracked cylinders, the chief advantages are small amount of preheating required; comparatively low melting point of the bronze filler rod, and its easy union with the cylinder casting, without melting the cylinder metal; greater strength of the welded joint, which is usually stronger than the cast iron of the piece; absorption of welding strains that would cause fracture with a welding rod of approximately the same material as the cylinder casting; less time required in preparation and actual welding with bronze than with the iron filler rod process.

Although oxy-acetylene welding, in the writer's opinion, is the ideal method of repairing cracked automobile cylinders, it may be of interest to describe briefly a few other methods whereby frost cracks in cylinders can be repaired satisfactorily.

Soldering Method

First file or chip a groove in the form of a V-groove, about 1/4 inch wide, the full length of the



Method of Mending Cracked Cylinder

crack, and thoroughly clean the metal for about 1/4 inch on each side of the groove. Then obtain a piece of soft brass rod and rub it well all over the cleaned surface around and in the groove until it has a "brassy" appearance. Next warm the cylinder until it is just too hot to touch, and have a well tinned soldering copper ready. Apply soldering flux and solder, and thoroughly tin the surface. Then proceed to fill up the V-groove and float the solder over each side. A cross-section of the soldered joint is shown at *A* in the illustration.

Brazing Method

In general, cast iron is more difficult to braze than most other metals because of the presence of free carbon or graphite in the metal. The most important factor in brazing defective automobile cylinders is cleanliness of the surfaces and the areas near the joint.

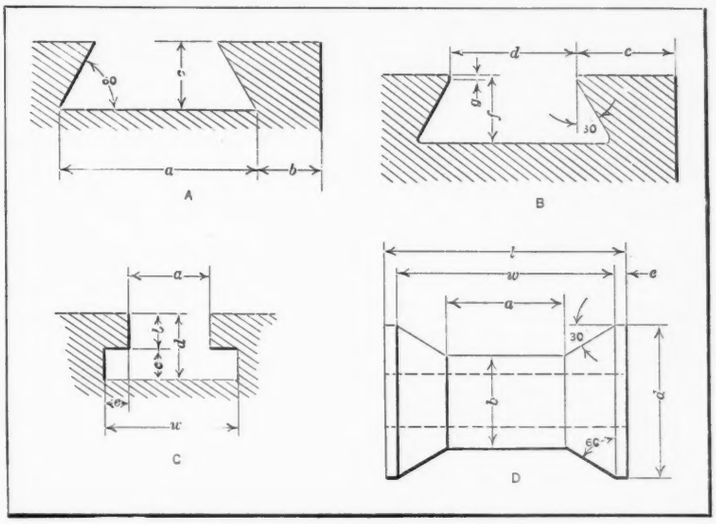
The surfaces should be cleaned by filing, chipping, or grinding. The cleaning should be carried to the bottom of the crack, which should be cleaned out with a stiff-bristled steel wire brush or a chasing tool, in order to remove the last trace of impurity. After the surfaces are thoroughly cleaned, heat up the casting on a good clean coke or hardwood charcoal fire to about 1750 degrees F. or a bright red heat. Insufficient heat is one of the chief causes of failure in cast-iron brazing.

A good flux for brazing defective automobile cylinders consists of boric acid 1 pound, pulverized chloride of potash 1/4 pound, and carbonate of iron 1/4 pound. This mixture should be kept dry, as moisture reduces its efficacy. Mix this flux with brazing spelter (63 per cent copper and 37 per cent zinc) just before using. After brazing, allow the casting to cool very slowly.

Repairing Crack with Screw Plugs

A very effective method of repairing cracked automobile cylinders without employing any source of heat whatever is by plugging with a chain of screws like the one shown at *B* in the illustration. With this method, first find the ends of the crack, and then start at one end, using a suitable tapping drill, and insert a headless screw as shown. The screws may be made from 4-inch diameter brass rod.

Having tapped the first hole and inserted the screw flush with the surface of the cylinder casting, drill the next hole half in the cast iron and half in the brass of the already inserted screw, and repeat the process until the other end of the crack is reached. The screws should then be calked with a ball peening hammer. This method, used in steam practice, will withstand a pressure of 230 pounds per square inch. Small cracks may often be repaired by this method without removing the cylinders from the car.



Method of Dimensioning Detail Parts

FORMING SMALL HOLES IN GLASS

E. F. P.—Can any of MACHINERY'S readers tell how to drill or form a hole 0.0002 or 0.0003 inch in diameter in a piece of glass?

Answered by Herbert C. Kimball

A.—It is common practice in the rayon industry to form minute holes in the glass spinnerets. Wires of the required diameter are placed in the glass while it is still molten. When the final product is set, these wires are dissolved by a suitable acid. I do not know whether all patent protection on this method has expired, but this can easily be ascertained.

WORKING DIMENSIONS ON DRAWINGS

By J. HOMEWOOD

The article entitled "Working Dimensions on Drawings," by Lawrence F. Swenson, which appeared in May MACHINERY, contains some interesting reminders for draftsmen. Draftsmen need prodding occasionally to remind them that they are directors and not mystifiers. They are supposed to direct the workmen by the use of pictures and figures. For that reason, they should have a knowledge of working conditions. Every stroke of the draftsman's pencil should have a definite purpose back of it; every dimension should mean something, and it should be useful to the man reading the drawing.

Referring to Fig. 1 in the article mentioned, which is reproduced, partially, in view *A*, I wish to discuss several points pertaining to dimensioning. As shown in view *A*, the dimensions *a* and *b* are terminal and do not facilitate matters for the workman. There is the same objection to dimension *a* as was given by Mr. Swenson for the calculated dimension 4.556 inches across the top of the opening. Where would the workman start to cut his dovetail under such a condition? There is no definite starting point for the workman to use.

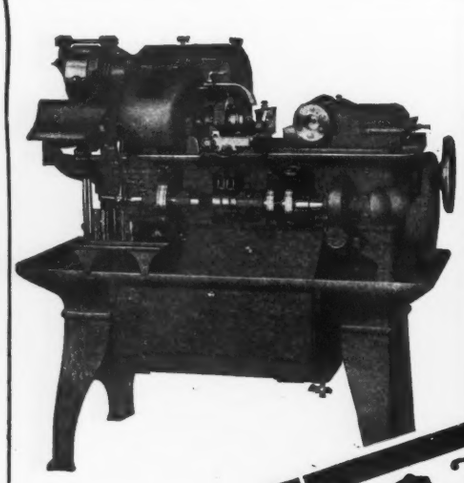
It seems to me that the drawing dimensioned as shown in view *B* would be of some service to the workman; he would know where to start, and would be able to rough out. It also eliminates sharp corners. There is no reason why dimension *d* could not be wider, which would give a flat as indicated at *g*.

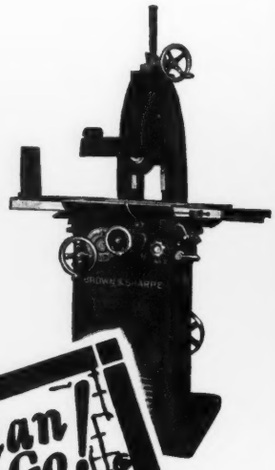
Regarding the angular dimension—whether to place it as shown in view *A* or as shown in view *B*—I am undecided. These angles should, of course, be such that the workman would not have to figure out the complement angle in order to set over the shaper or planer head. If the slot is to be milled, the method of dimensioning indicated in view *A* would suffice.

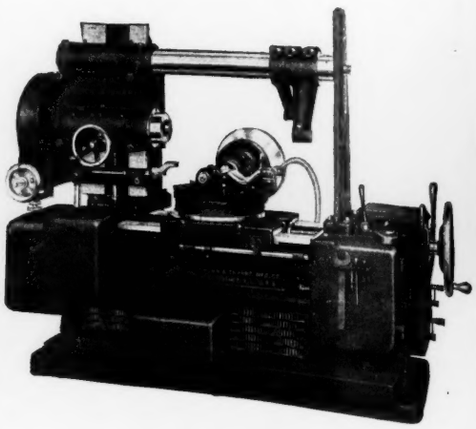
In view *C* is shown a T-slot. The principal dimensions required are *d*, *a*, *w*, and *c*. It may facilitate matters for the workman to have dimension *e* also. I see no use in giving *b*.

View *D* shows a drawing of a spool to be turned in a lathe. It is sometimes dimensioned as shown by the letters, but it is more convenient to have the angular dimension also—either the 30 or 60 degrees.

There are myriads of little points that, if overlooked, result in confusion and loss of time and that would pay the draftsman to study carefully with an old-timer in the shop.







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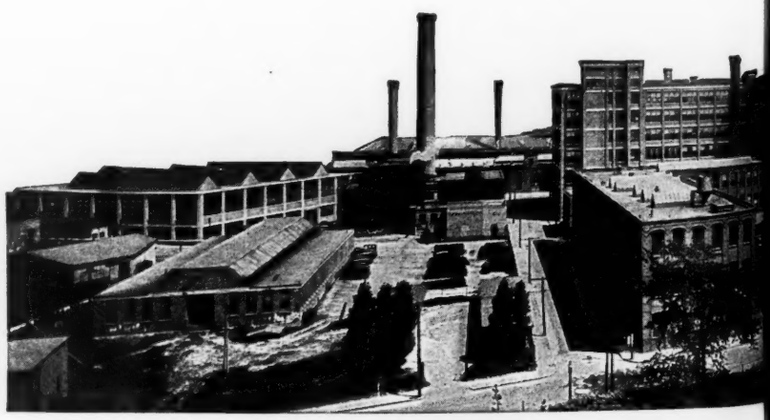

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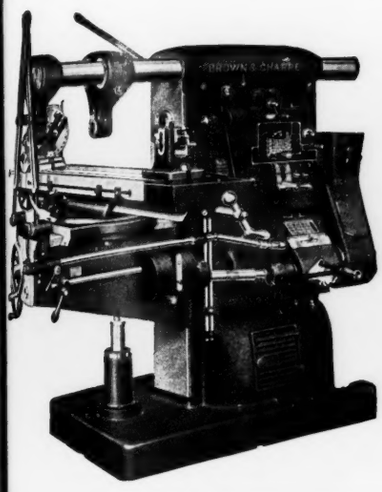

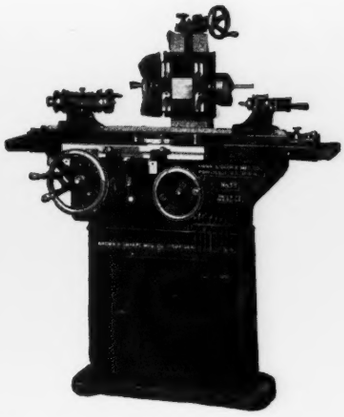

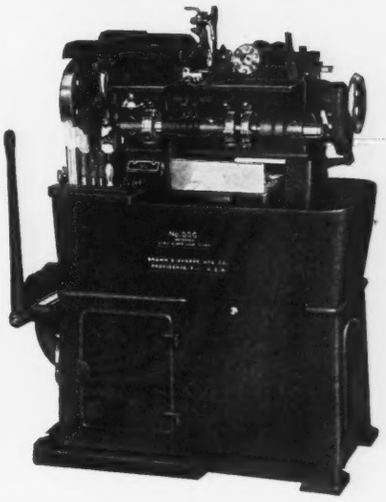

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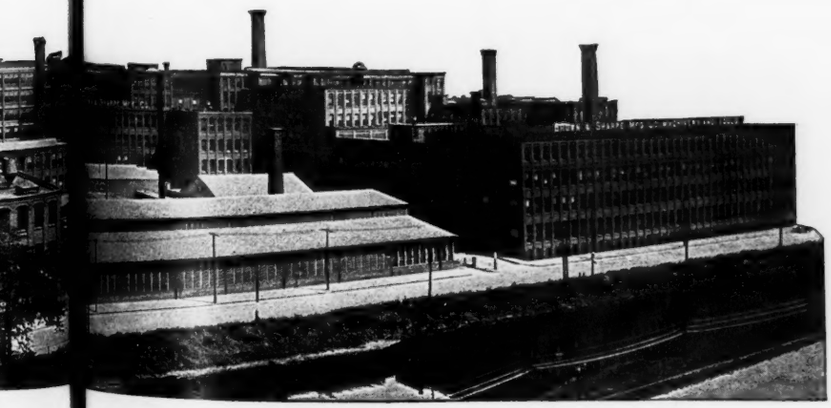

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OBITUARIES

ERNEST B. PERRY, president of the Industrial Works, Bay City, Mich., manufacturers of cranes, died at his home in Bay City August 7 from heart disease, after an illness of one week. Mr. Perry was born in Prairie Du Chien, Wis., in 1868 and went to the Industrial Works in 1889 after graduating from the mechanical engineering department of the University of Michigan. At first he was employed as draftsman, but two years later he was made superintendent and mechanical engineer, and later vice-president and general manager. In 1924 he became president of the concern. He was a member of the American Society of Mechanical Engineers and of many other national organizations. He was also director of the research department of the University of Michigan, and a trustee of the University Alumni fund.

H. O. SEYMOUR, director of the Chain Belt Co., Milwaukee, Wis., died of heart failure July 23 at his country home at Lake Geneva, Wis. Mr. Seymour had been a director of the Chain Belt Co. since 1918. He was also president of the First Wisconsin Trust Co., an executive vice-president of the First Wisconsin National Bank, and a vice-president of the First Wisconsin Co., all of Milwaukee, Wis.

PERSONALS

A. O. BREDEMERE has been appointed district manager of sales for the National Acme Co., Cleveland, Ohio, at the office in Detroit, Mich.

LYNN B. MCKNIGHT, for the last eight years with the Dodge Mfg. Co., has been appointed sales manager of the Stearns Conveyor Co. of Cleveland, Ohio, manufacturer of belt conveyors, which firm is owned by the Chain Belt Co. of Milwaukee, Wis.

CHARLES G. OLSON, formerly connected with the sales department at the main office of the Chain Belt Co., Milwaukee, Wis., has been transferred to the Detroit office, where he will look after the Rex chain and engineering business of the company in the Detroit territory, with headquarters at the company's office at 8855 Woodward Ave.

C. E. SKINNER, assistant director of engineering, and W. BRADSHAW of the supply sales department, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., sailed August 17, on the *George Washington*, as delegates to the International Electrotechnical Commission Convention, which will be held at Bellagio, on Lake Como, Italy, September 4 to 24.

JOHN A. TOLEIK, for seventeen years with the American Can Co., has become chief engineer of the Gibb Welding Machines Co., Bay City, Mich. Mr. Toleik has been in charge of welding developments with the American Can Co., and will give his chief attention in his new connection to the research department of the Gibb Welding Machines Co.

E. D. TREANOR has been appointed managing engineer of the distribution transformer department at the Pittsfield, Mass., works of the General Electric Co. As managing engineer of that department, Mr. Treanor will also have general supervision of the engineering on distribution transformers manufactured at the Fort Wayne, Ind., and Oakland, Cal., works of the company.

WALLACE J. HORNELL has joined the Toronto staff of the Arthur Jackson Machine Tool Co., Toronto, Ontario, Canada. He will specialize principally in portable electrical equipment and tool-room supplies. Mr. Hornell served his apprenticeship in the machine shops of the Canadian National Railways, and was afterward toolmaker with C. H. Taylor & Co. and A. Schrader & Sons, Toronto. Recently, he has been connected with a large sales and advertising agency.

T. D. LYNCH, manager of the materials and process engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., sailed for Europe on August 1 for a two months' business tour. While he is on the continent he will attend the meetings of the International Congress for Testing Materials at Amsterdam, Holland, September 12 to 17. As vice-president of the American Society for Testing Materials, he has been appointed chairman of the commission representing this society at the congress. He will also present a paper entitled "Materials as a Stimulus to Research" at one of the meetings.

TRADE NOTES

SKINNER CHUCK CO., New Britain, Conn., has appointed Thomas H. Winston as representative to cover the southern territory. Mr. Winston's address will be 1133 Real Estate Trust Bldg., Philadelphia, Pa.

JOSEPH TRACY TESTING LABORATORY, 1819 Broadway, New York City, has been appointed the official testing plant of the New York Automobile Club, Inc. Investigations and tests on such automotive devices as may be submitted to the club will be made in this laboratory.

AKRON TOOL CO., 920 S. High St., Akron, Ohio, announces that the company has been incorporated and will be known in the future as AKRON TWIST DRILL CO., INC. George R. Hine is president and sales manager. He was previously with the Whitman & Barnes Co. for twenty-five years.

BEVAN & EDWARDS PTY. LTD., 117-129 King St., Melbourne, Australia, announces that the firm is now known (effective July 1) as E. P. BEVAN & SON, PTY. LTD., W. Edwards having sold his interest to E. P. Bevan. Business will be carried on at the same address as formerly, the same lines being handled as hitherto.

LINCOLN ELECTRIC CO., Cleveland, Ohio, has moved its Missouri district office from 1808 Railway Exchange Bldg., St. Louis, Mo., to 1003 Davidson Bldg., Kansas City, Mo., Robert Notvest being in charge. A branch office has also been established at 220 Nicholas Bldg., Toledo, Ohio, in charge of A. H. Homrighaus.

MACHINERY CLUB OF CHICAGO has opened new quarters at 671 W. Washington Blvd., on the southeast corner of Washington Boulevard and Union Street. The club has been entirely refurnished and decorated and will meet the needs of the machinery, tool, and allied industries in a way that will make it a real asset in this field.

CAR-MOR METAL CO., Gaul and Gordon Sts., Philadelphia, Pa., has been organized by H. L. Carpenter, Jr., and John A. Morrison. The new company will buy, sell, and manufacture non-ferrous metals. Both of the founders of the company have been in the service of the Ajax Metal Co., Philadelphia, Pa., for over twenty-five years.

SPROUT, WALDRON & CO., Muncy, Pa., have taken over the patterns and equipment of the Valley Iron Works, Williamsport, Pa., and will in the future handle all Monarch transmission appliances. To take care of the transmission business, a new machine shop and stock-room, with 5000 square feet of floor space, has been built and equipped.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that the company will engage in the commercial production of molded products for mechanical and electrical purposes, including radiatron bases, knobs, dials, and other radio parts, parts for industrial control equipment and wiring devices, and all forms of molded insulation. These products will be marketed under the trade name "textolite molded" parts.

HENRY G. THOMPSON & SON CO., New Haven, Conn., manufacturer of metal cutting saws and saw machines, announces that Daniel W. Northrup has been elected president and general manager, succeeding D. C. Smyth, who has been elected treasurer. For the past twenty-five years Mr. Northrup has been connected with the Bassett Metal Goods Co., Inc., Shelton, Conn., serving as vice-president with this company for the past ten years.

BARNES DRILL CO., 814 Chestnut St., Rockford, Ill., announces that W. G. Nichol, formerly with Manning, Maxwell & Moore, New York City, will be direct factory sales engineer for the Barnes Drill Co. in the Connecticut and western Massachusetts territory. Mr. Nichol's home address will be Stamford, Conn. Mr. Nichol has also been with the E. W. Bliss Co., Brooklyn, N. Y. The Barnes Drill Co. is cooperating in a direct sales program with the Sundstrand Machine Tool Co., as the lines of the two companies supplement each other.

ELECTRIC ARC CUTTING & WELDING CO., Newark, N. J., announces that the alternating-current arc-welding patents owned by the Electric Arc Cutting & Welding Co., known as the Holslag patents, and the inductive reactor alternating-current patents known as the Arendt patents, owned by the Owen Electric Mfg. Co., Fayetteville, N. C., have been combined into one license consolidation. It is stated that a large number of firms making alternating-current cutting and welding machines have applied for a license under the arrangement made.